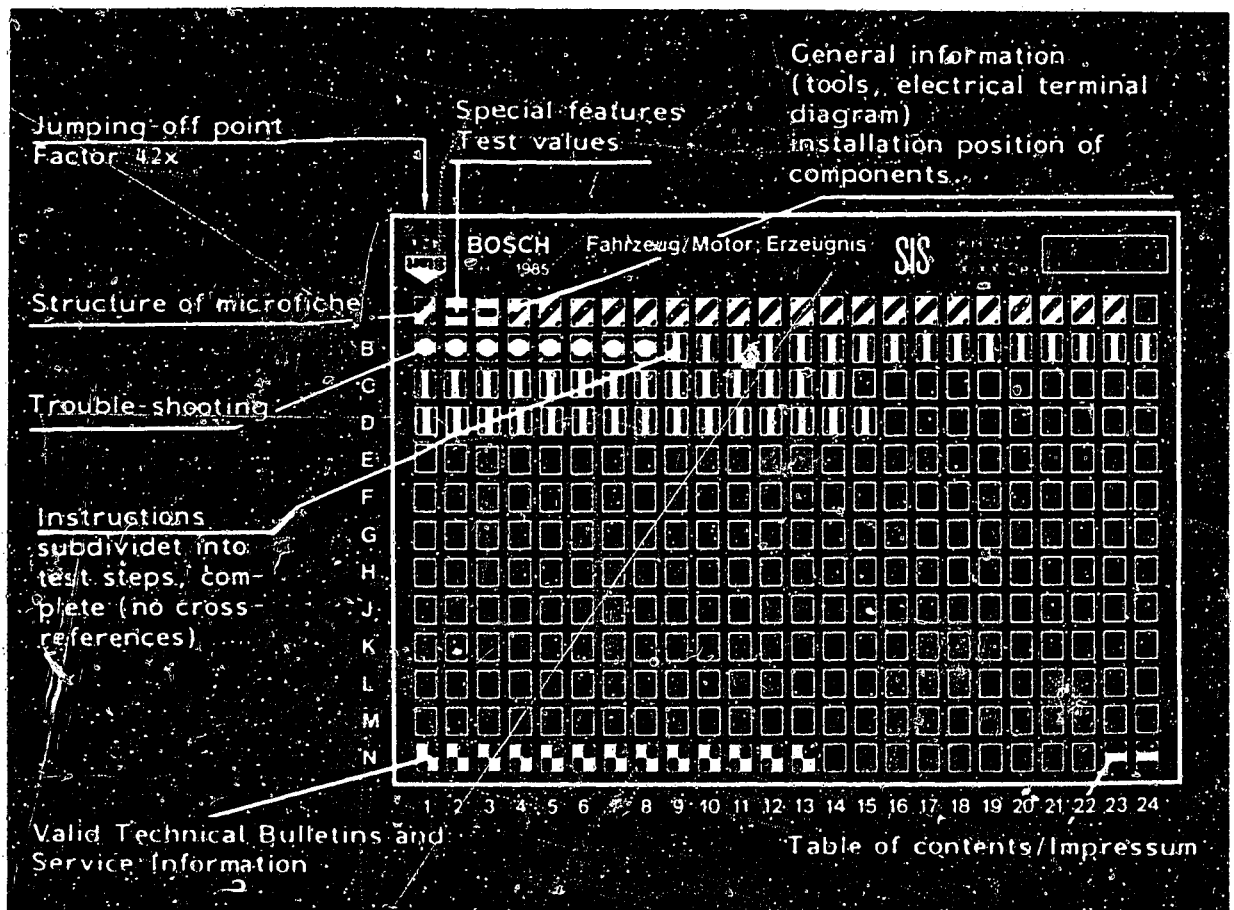


# Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

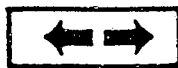
<b>E16</b>	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section



Beginning



Mid-section



End



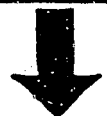
One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

**C6**

**A1**

Trouble-shooting program



## 1. Special features

The vehicles are equipped with the following:

Trigger box	0 227 100 124 (with current limitation)
Ignition coil	1 227 020 009
Spark advance mechanism	0 227 921 020 Manually shifted transmission 0 227 921 023 Automatic transmission

## 2. Test specifications

Ignition coil primary	0.6...1.0 $\Omega$	<b>B11</b>
Ignition coil secondary	6.4...11.1 k $\Omega$	

Basic ignition timing with engine idling and engine oil > + 60°C	10° BTDC	<b>B17</b>
--	----------	------------

Set point for engine idling with manually shifted transmission	800 $\pm$ 25 rpm
with automatic transmission	700 $\pm$ 25 rpm

Temperature sensor	<b>C1</b>
> approx. + 17°C	
< approx. + 17°C	

Oil temperature switch	<b>C3</b>
< approx. + 65°C	
> approx. + 65°C	



Power supply  
to trigger box  
with engine idling

12...14 V

**C13**

Power supply  
to ignition coil  
with engine idling

$\geq 10$  V

**D4**

Power supply  
to ignition pulse generator

$\geq 10$  V

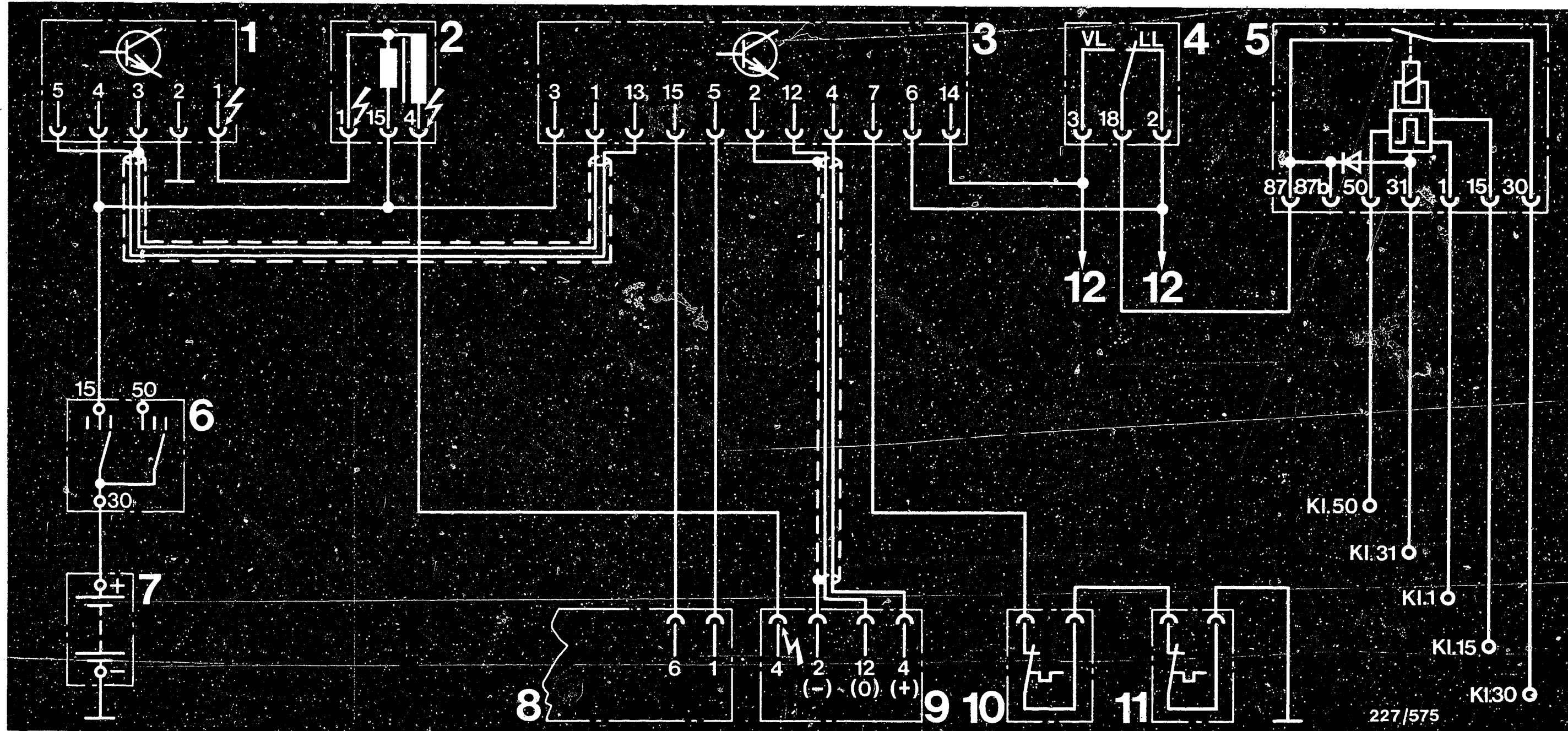
See Autodata test specifications for settings for  
ignition, exhaust, valve clearance etc.

**A3**

Test specifications

Opel





Dangerous-voltage arrows:  
Caution, 400 V ... 25 kV

### 3. Electrical terminal diagram

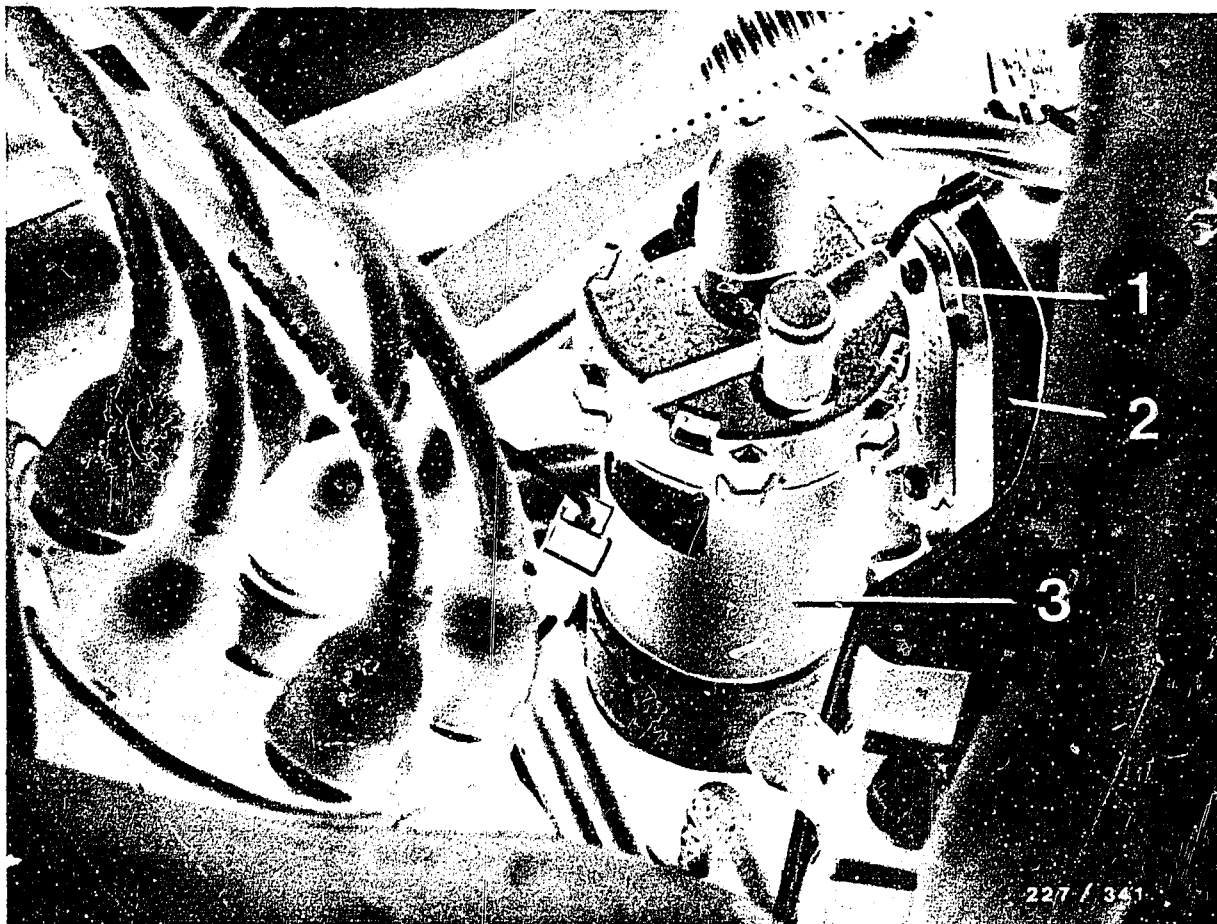
- 1 = Trigger box
- 2 = Ignition coil
- 3 = Spark advance mechanism
- 4 = Throttle valve switch

- 5 = Control relay L-Jetronic
- 6 = Ignition/starter switch
- 7 = Battery
- 8 = L-Jetronic control unit

- 9 = Ignition distributor  
10 = Temperature sensor  
11 = Oil temperature switch  
12 = To L-Jetronic  
K1. = Term.





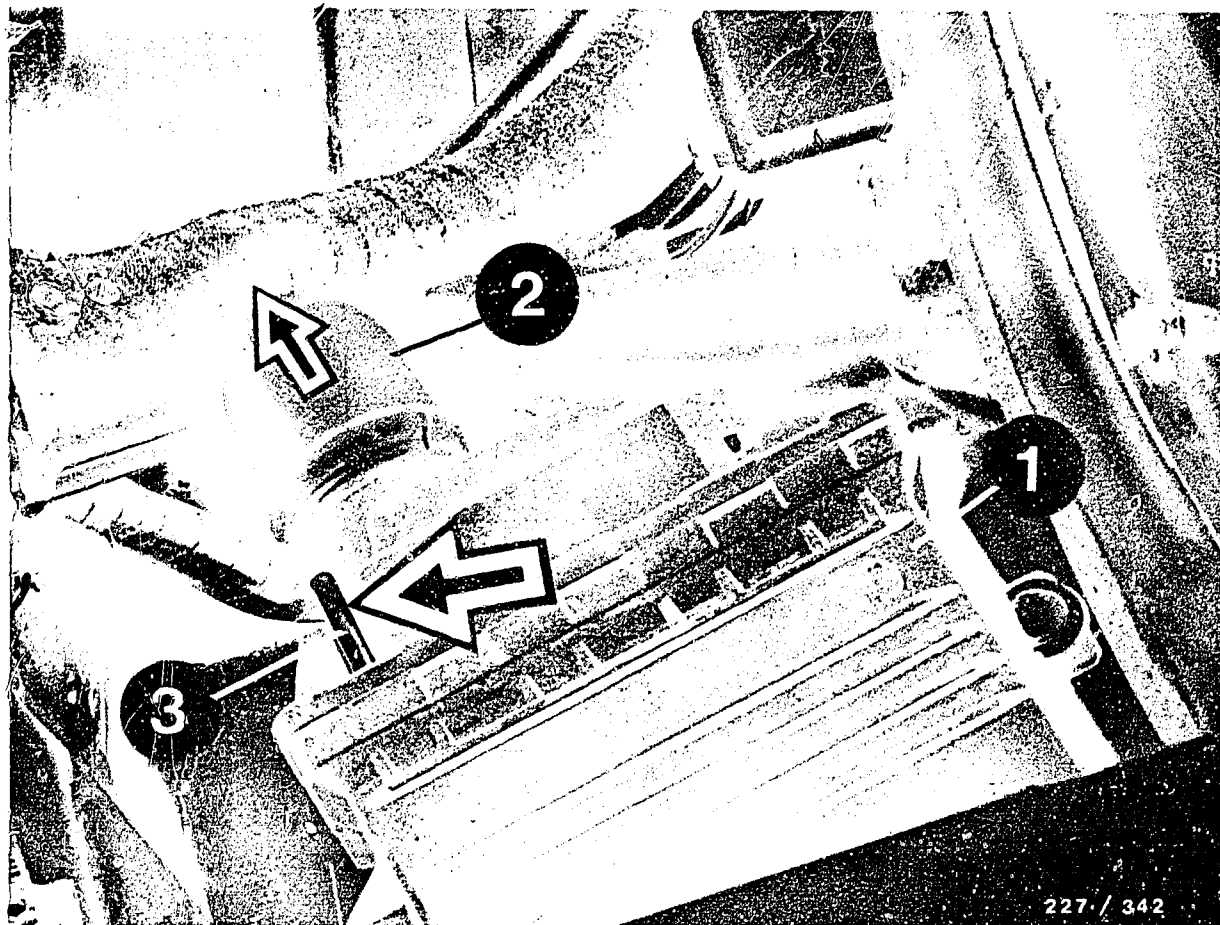


- 1 = TI trigger box
- 2 = Heat sink
- 3 = Ignition coil

#### 4. Installation position of components

The trigger box and ignition coil are mounted on a common heat sink. See picture.





- 1 = Timing advance unit
- 2 = Timing advance unit plug
- 3 = Detent

The timing advance unit is on the wheelbox on the left-hand side in the forward direction of travel. See picture.

How to remove:

To be able to remove the plug, the timing advance unit must be removed.

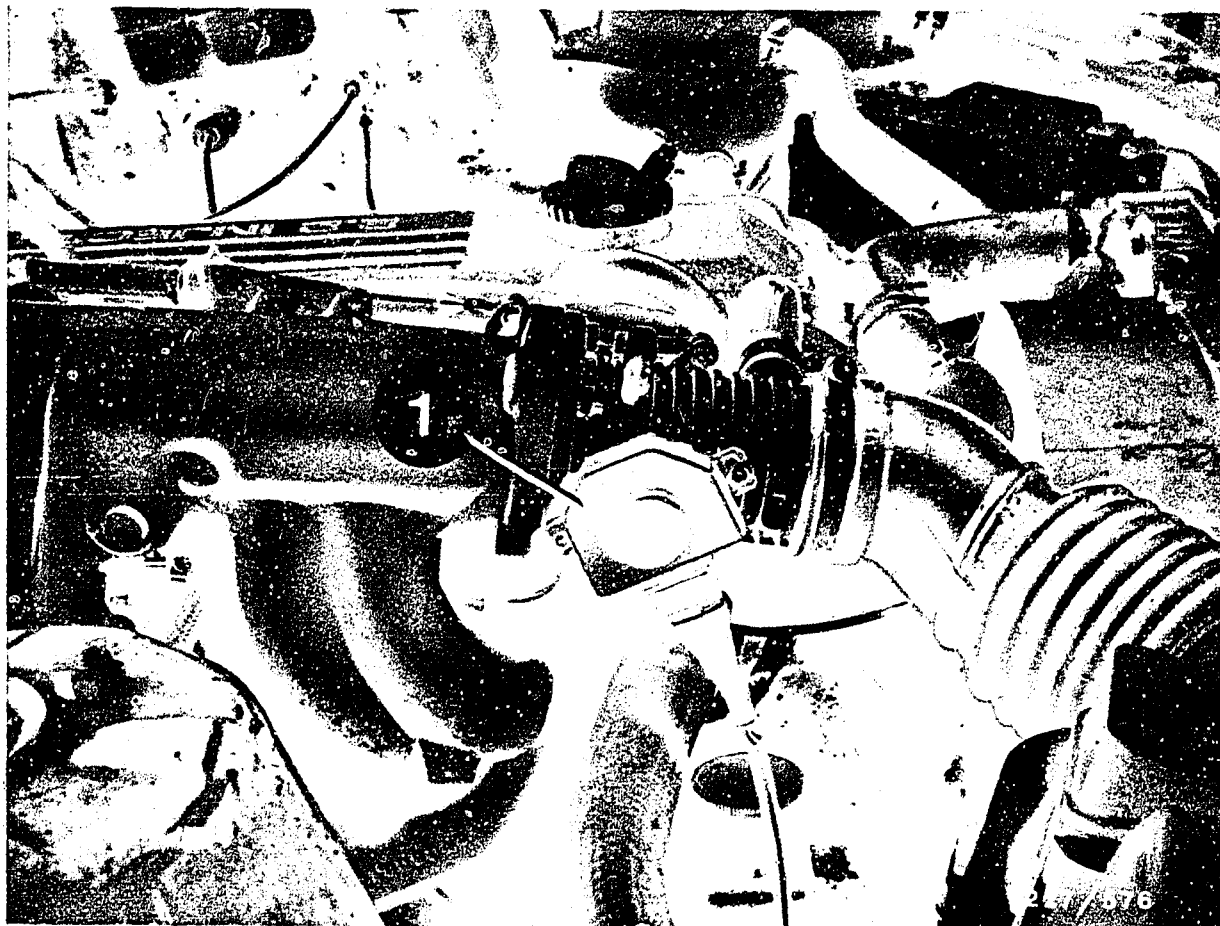
Press detent for timing advance unit plug in direction of arrow, and hinge plug in direction of arrow.

**A7**

Installation position of components

Open





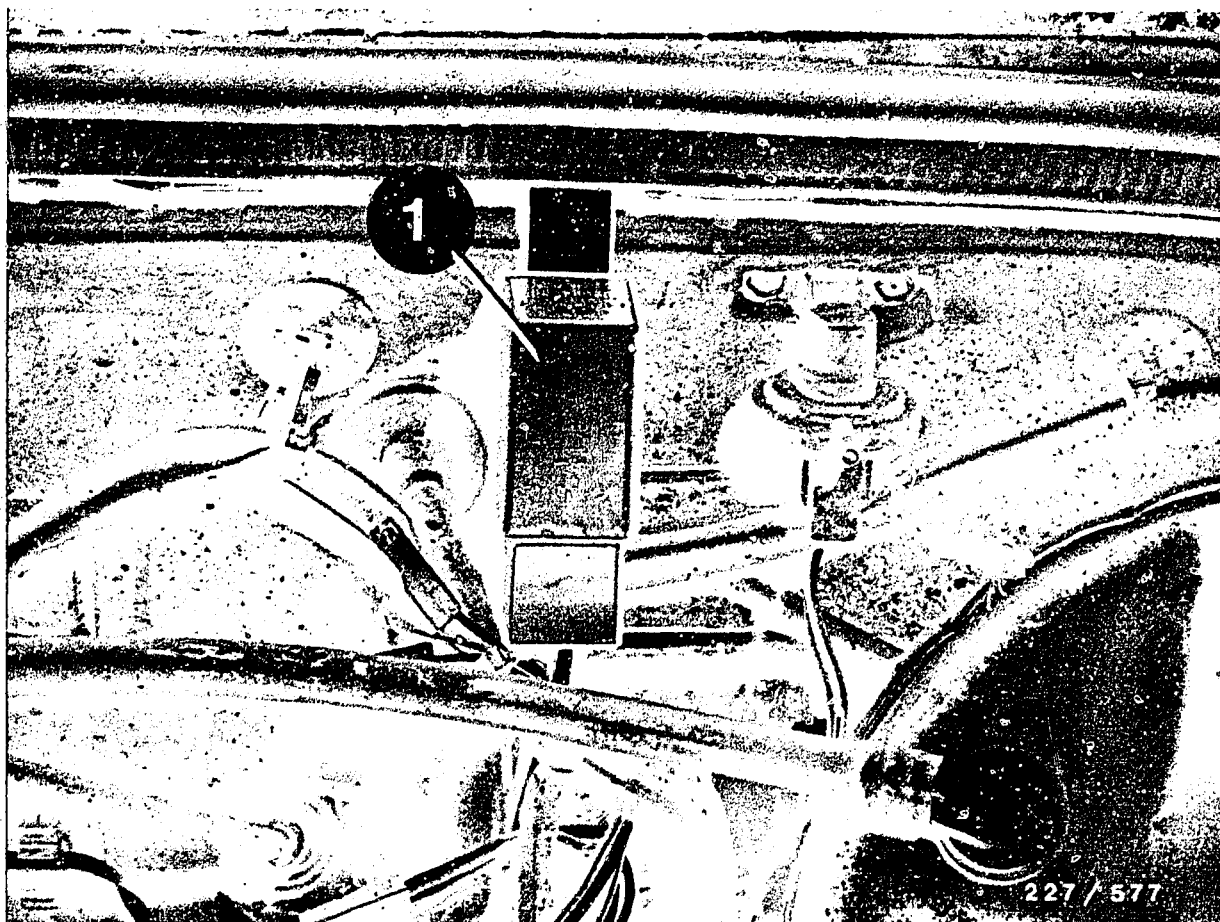
1 = Throttle-valve switch

**A8**

Installation position of components

Open





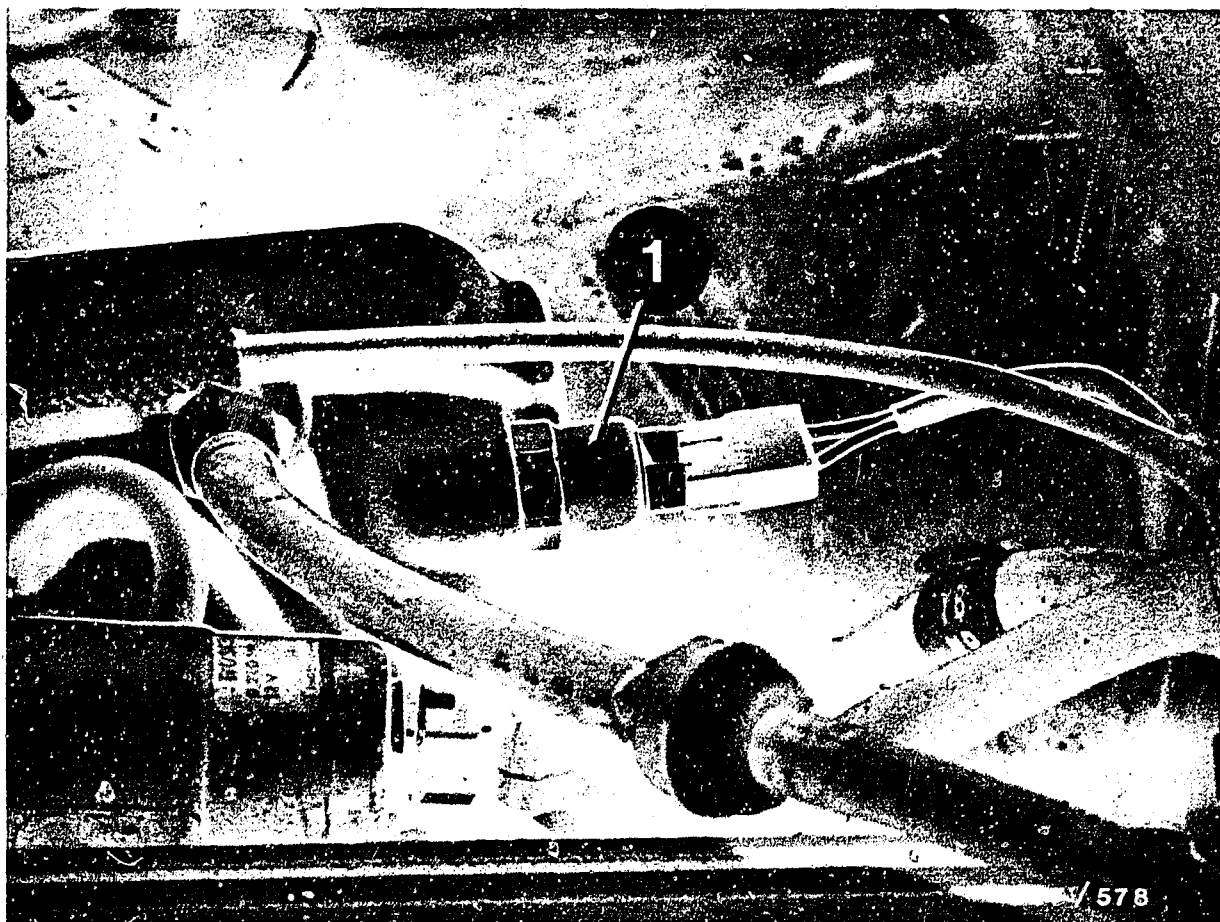
1 = Control relay for L-Jetronic

**A9**

Installation position of components

Opel



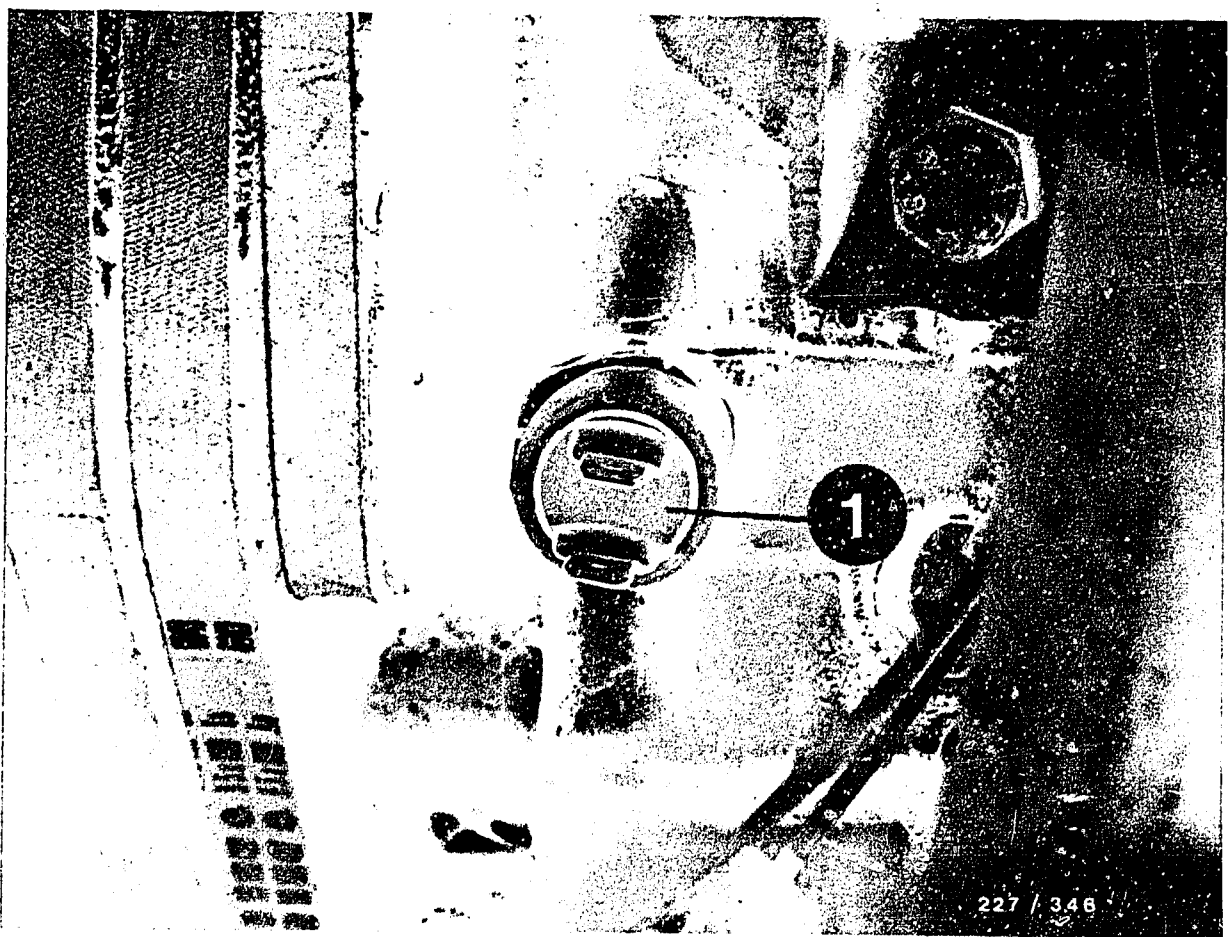


1 = Temperature sensor

**A10**

Installation position of components  
Open





1 = Oil-temperature switch

The oil-temperature switch is at the front on the engine on the left-hand side in the forward direction of travel. (Near crankshaft pulley).

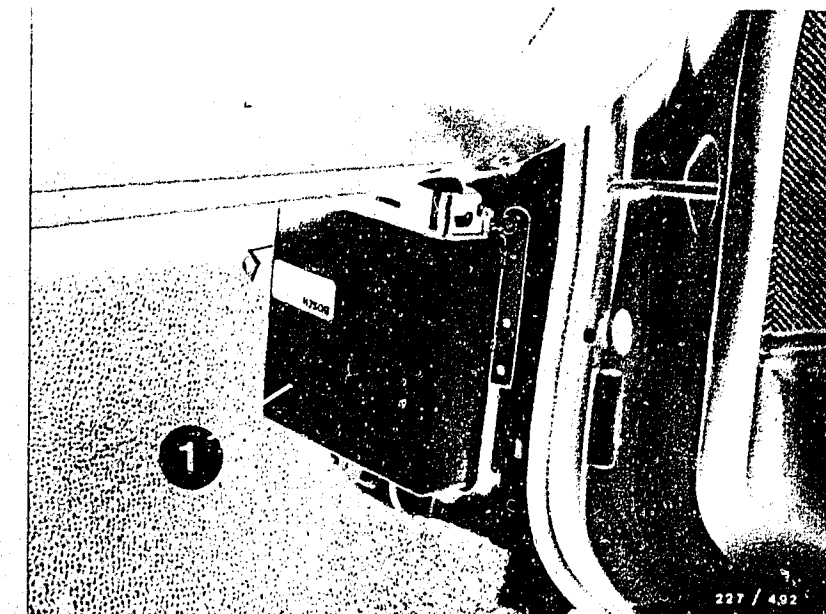


The L-Jetronic control unit is located at the front right in the passenger compartment. Figure at top.

Instructions for taking out:

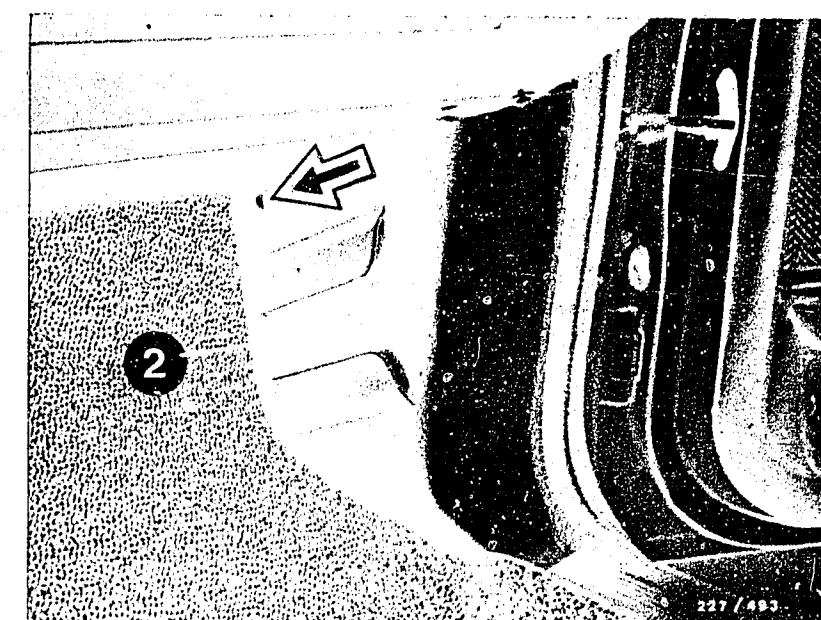
Pull out the plug (arrow, figure at bottom) and take off the side wall panel.

To pull out the L-Jetronic control unit plug, take out the control unit.



1 = L-Jetronic control unit

2 = Side panel



**A12**

Installation position of the components

Opel



**A13**

Installation position of the components

Opel



## 5. Necessary test equipment, aids

Motortester e.g.	MOT 201	0 684 000 201
Spark gap, e.g. ignition coil and condenser tester or single spark gap	EFAW 106 A EF 1177/7	0 681 100 001 1 684 531 000
5 k $\Omega$ sleeve-type suppressor		0 356 500 001
Ohmmeter	ETE 014.00	0 684 101 400
or e.g.	Pontavi Wh2	commercially available
Voltmeter e.g.	ETE 014.00	0 684 101 400
Thermo conduction compound		5 942 860 003
2 auxiliary cables to be made up by user, each consisting of approx. 90 mm cable 1.5 m <sup>2</sup>		6 210 ..
4 blade terminals e.g.		8 784 480 011
Short-circuiting device (for basic ignition timing)		KDZS 0003
Connection lead for ignition coil (for term. 1 green)		1 684 443 055
Connection lead for ignition coil (for term. 15 yellow)		1 684 443 054
Test leads (for correct connection of test equipment to vehicle connectors)		KDZS 0004
Test prods (for correct connection of test equipment to vehicle connectors)		commercially available





## 6. Danger of accident on electronic ignition systems

Increased demands of modern engines on the ignition system combined with the desire for freedom of maintenance have recently led to electronic ignition systems being fitted as standard. Usually the ignition power of electronic systems (of almost all manufacturers) is higher than that of conventional systems, and there are signs of further increases in power. Electronic ignition systems thus reach a power range which can be highly dangerous if live parts of terminals are touched (both on the primary as well as the secondary sides).

In this connection we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.

The ignition should always be switched off when working on the ignition system (switch off ignition or voltage source). Such work includes:

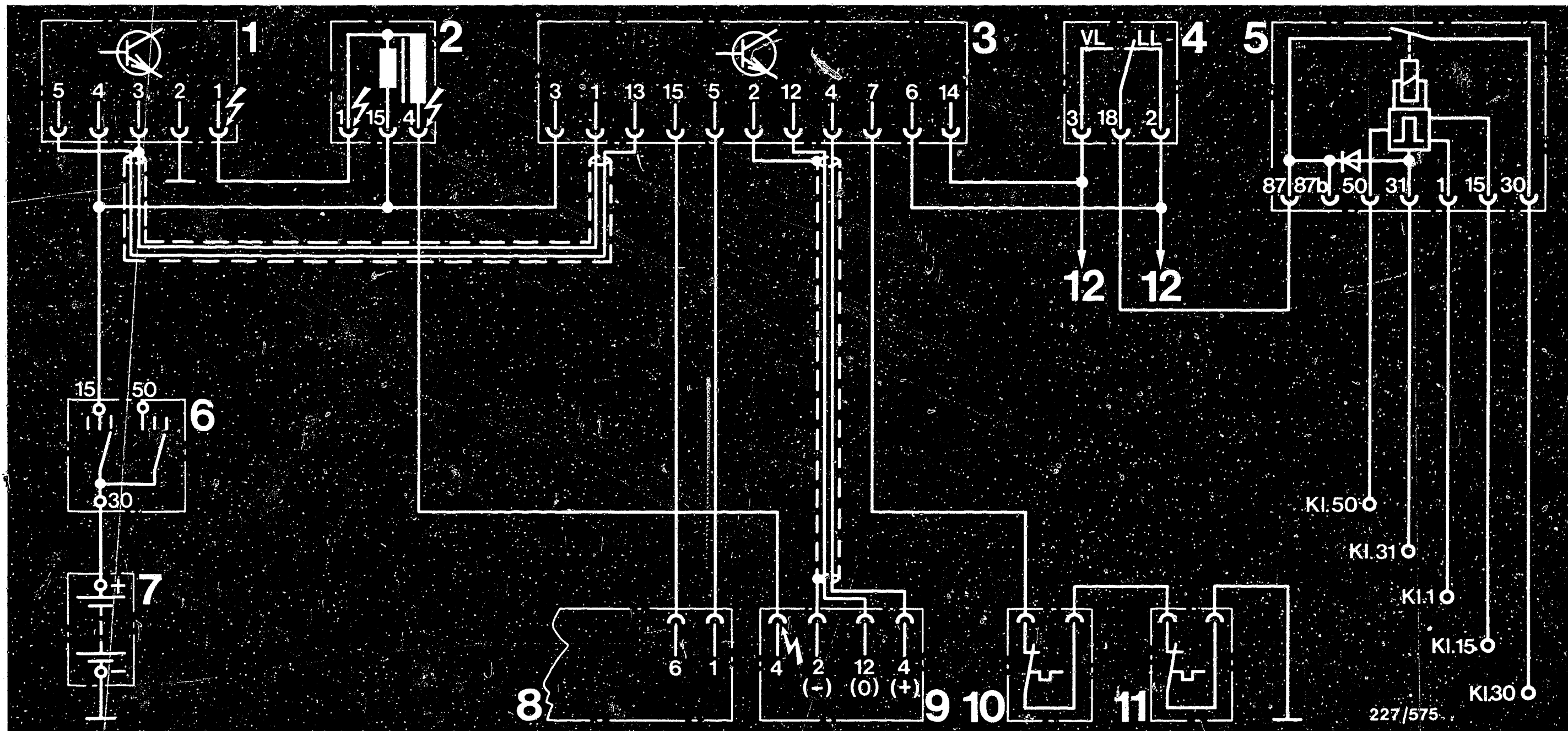
- Connecting of engine test equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, ignition cable etc.).



If, while testing the ignition system or during adjustment work on the engine (e. g. L-Jetronic) , it becomes necessary to switch on the ignition (switch on ignition or voltage source), the above-mentioned dangerous voltages occur over the entire system.

The danger of accident exists, therefore, not only on the individual assemblies of the ignition system (e. g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e. g. tachometer connection, diagnostic plug), at plug-in connections and test equipment.





Dangerous-voltage arrows:  
Caution, 400 V ... 25 kV

The dangerous locations are marked with danger arrows taking the example of the terminal diagram of an electronic ignition system.

#### Electrical terminal diagram

- 1 = Trigger box
- 2 = Ignition coil
- 3 = Spark advance mechanism
- 4 = Throttle valve switch

- 5 = Control relay L-Jetronic
- 6 = Ignition/starter switch
- 7 = Battery
- 8 = L-Jetronic control unit

- 9 = Ignition distributor
- 10 = Temperature sensor
- 11 = Oil temperature switch
- 12 = To L-Jetronic
- K1.= Term.

**A17**

Electrical terminal diagram

Opel



**A18**

Electrical terminal diagram

Opel



7. Incorrect indication of engine speed, dwell angle  
and ignition point

In ignition systems with trigger box 0 227 100 124  
( TZ ) with current limitation there may be an incorrect  
indication of engine speed, dwell angle and ignition  
point on testers.

For further details see coordinates N 8 - N 12.



## 8. Important vehicle information

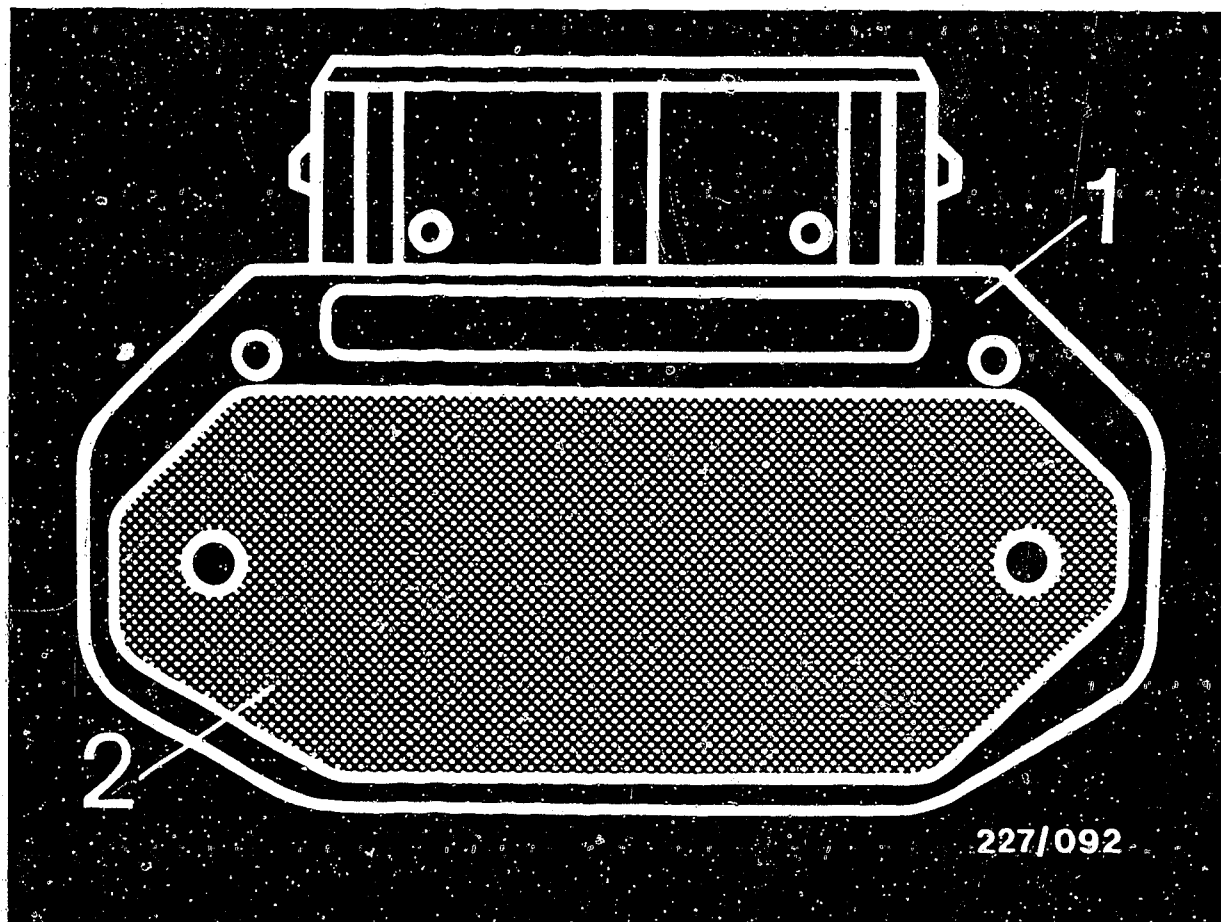
- Resistance measurements must be performed only with the ignition switched off or with the battery disconnected (risk of measuring instrument defect).
- During the compression test, either pull off the trigger-box plug or firmly connect terminal 4 of the ignition coil to ground using an extra cable (risk of dangerous voltages, insulation damage at ignition coil, ignition distributor or ignition harness).

### Note:

The auxiliary cable must be suppressed with at least 2 k $\Omega$ , e.g. with the interference suppression sleeve (5 k $\Omega$ ) 0 356 500 001.

- The specified ignition coil (see Part No.) must not be replaced by another ignition coil.
- A suppression capacitor must not be connected to ignition coil terminals 1 and 15.
- Ignition coil terminal 1 must not be connected to ground as an anti-theft device (when the ignition is switched on, the ignition coil will be destroyed).
- A positive battery terminal or test lamp must not be connected to ignition coil terminal 1 (trigger box will be destroyed).
- The ignition lead from ignition coil terminal 4 to ignition distributor terminal 4 must not be disconnected while the engine is running.
- It must be ensured that voltage flashovers do not occur from ignition coil terminal 4 to ignition coil terminal 1 and 15. The ignition vane switch and trigger box may be destroyed.



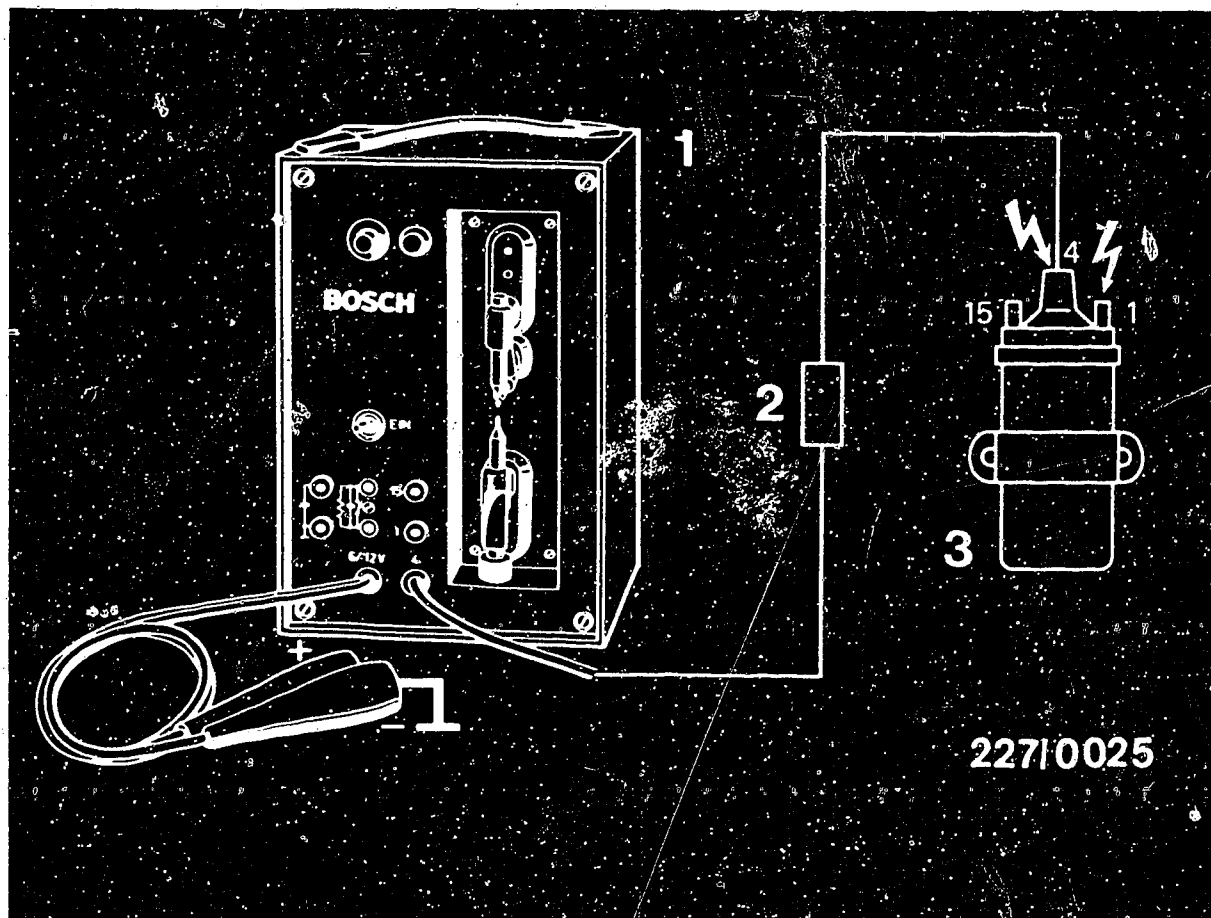


1 = Trigger box


2 = Base plate

- Before mounting the trigger box, the base plate must be coated with thermal conduction paste. Apply thermal conduction paste only with a suitable object (screwdriver, matchstick etc.)

Do not apply thermal conduction paste to painted parts.



- 1 = Spark gap
- 2 = 5 k $\Omega$  sleeve-type suppressor
- 3 = Ignition coil

 = dangerous voltages (400 V - 25 kV)

- In order to prevent the trigger box from being irreparably damaged, when using a spark gap, an interference-suppression resistor of at least 2 k $\Omega$  must be connected between the spark gap and ignition coil terminal 4, e. g. sleeve-type suppressor (5 k $\Omega$  ) 0 356 500 001.

- In order to prevent the trigger box from being irreparably damaged, the secondary side of the ignition system must have at least 2 k  $\Omega$  interference suppression whereby the original distributor rotor with 1 k  $\Omega$  interference-suppression resistor must be fitted (even in the case of radio and spark interference suppression do not use a 5 k  $\Omega$  distributor rotor).
- No external voltage, e. g. ohmmeter, must be connected to the ignition distributor magnetic pickup assembly (Hall generator).

Caution when switching over measuring ranges.

- The line from the Hall generator to the ignition timing unit and from the ignition timing unit to the trigger box must be shielded (malfunction of ignition timing unit/trigger box).
- The holding springs of the distributor cap must not drop into the pickup system when the engine is being cranked and with the dust-protection cover removed.
- Arcing or breakdown of insulation at the distributor cap (poor insulation) may lead to the destruction of the magnetic pickup assembly and trigger box.
- Do not disconnect battery with engine running.
- Incorrect battery polarity will lead to the destruction of the magnetic pickup assembly of the ignition distributor, trigger box and ignition coil as well as ignition timing unit.
- Do not use a starting aid with more than 16 V or a fast charger for starting.





## 9. Trouble-shooting program

### 9.1 Procedure - trouble-shooting chart

The trouble-shooting chart starting on Coordinate B 3 contains customer complaint (fault symptoms), cause of trouble, test instructions and coordinate reference.

The possible cause of the fault should be selected from the trouble-shooting chart in accordance with the customer complaint (fault symptom).

If the cause of the fault is not clear, start testing with the detailed, self-contained trouble-shooting program beginning on Coordinate B 7.

If the cause of the fault is clear from the trouble-shooting chart, direct trouble-shooting is possible by going to the stated coordinate without having to perform the entire trouble-shooting program for each fault.

If there is no coordinate reference, trouble-shooting must be performed in accordance with the "Test instructions" column.

### 9.2 Procedure - trouble-shooting program

The trouble-shooting program starting on Coordinate B 9 is divided into 3 rows of boxes.

The left-hand row contains test instructions and test specifications.

The center row contains repair instructions.

The right-hand row contains the illustrations/terminal diagrams belonging to the text and the explanations of the items in the picture.

If the questions asked in the left-hand row can be answered conclusively with "yes", then proceed to the next test down.

### 9.3 Before testing, make sure of the following:

Battery fully charged, fuel system O.K., engine mechanically O.K. (e. g. compression, valve clearance etc.). Ambient temperature/ignition system temperature 0° to 100° C (temperature has a considerable effect on measured values).

**B1**

Trouble-shooting program  
Opel

**B2**

Trouble-shooting program  
Opel



## 9.4 Trouble-shooting chart

### Customer complaint (fault symptom)

1. Starting motor operates, but engine fails to start

2. Rough idling

3. Poor throttle response

4. Engine lacks power

5. Misfiring

6. Fuel consumption too high

7. Engine pings when accelerating

8. Backfiring

9. Engine becomes too hot

									Cause of trouble	Test instructions	Coordinates
●	●	●	●	●	●	●	●	●	Unclear	Perform detailed trouble-shooting	B 9
●	●	●	●	●	●		●		Spark plugs defective	Evaluation by means of ignition oscilloscope, or visual examination of removed spark plug	-----
●	●	●	●	●					Shunt on secondary side	Evaluation of ignition coil, ignition distributor, ignition harness and spark plug by means of ignition oscilloscope or visual examination	-----
●	●	●	●	●					Open circuit on secondary side	Evaluation of ignition coil, ignition distributor, ignition harness and spark plug by means of ignition oscilloscope, or continuity test with ohmmeter	-----
●									Open circuit on primary side	---	D 1
●	●	●	●	●					Ignition coil defective	---	B 11
		●	●	●	●				Interference-suppression resistors defective	Evaluation by means of ignition oscilloscope or resistance measurement	-----

**B3**

Trouble-shooting program

Opel



**B4**

Trouble-shooting program

Opel



# Rapid diagnosis chart

## Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start											
2. Rough idling											
3. Poor throttle response											
4. Engine lacks power											
5. Misfiring											
6. Fuel consumption too high											
7. Engine pings when accelerating											
8. Backfiring											
9. Engine becomes too hot											
								<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>	
●	●	●	●	●	●	●	●	●	Basic ignition timing incorrect	-	B 17
			●		●				Control line for characteristic control defective	-	B 19
			●		●				Temperature sensor defective	-	B 23
			●		●				Oil temperature switch defective	-	C 1
			●		●				Throttle valve switch defective	-	C 3
			●		●				Load signal defective	-	C 9

**B5**

Rapid diagnosis chart

Opel



**B6**

Rapid diagnosis chart

Opel



# Rapid diagnosis chart

## Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start

2. Rough idling

3. Poor throttle response

4. Engine lacks power

5. Misfiring

6. Fuel consumption too high

7. Engine pings when accelerating

8. Backfiring

9. Engine becomes too hot

									<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>
●									Power supply for trigger box defective	-	D 1
●									Magnetic pulse generator defective	-	D 3 ... D 7
●									Spark advance mechanism defective	-	D 8
●									Rotational speed signal defective	-	D 12
●							●		Ignition sequence incorrect	See Autodata test specifications	----

**B7**

Rapid diagnosis chart

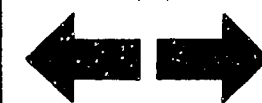
Open



**B8**

Rapid diagnosis chart

Open



## 9.5 Trouble-shooting program

Test primary signal. If no oscilloscope or tachometer available, check whether ignition spark across spark gap.

Primary signal testing with oscilloscope  
Connect oscilloscope to ignition coil as per operating instructions.  
Start engine.  
Oscilloscope must indicate a primary voltage (of any value).

Primary signal testing with tachometer  
Connect tachometer to ignition coil as per operating instructions.  
Start engine.  
Tachometer must indicate a reading (of any value).

Ignition spark testing with spark gap  
Remove H.T. igniton cable terminal 4 from ignition coil.  
Connect spark gap including sleeve-type suppressor (5 k $\Omega$ ) to ignition coil.  
Adjust spark gap to 5 mm.  
Start engine.  
There must be sparks across the spark gap.

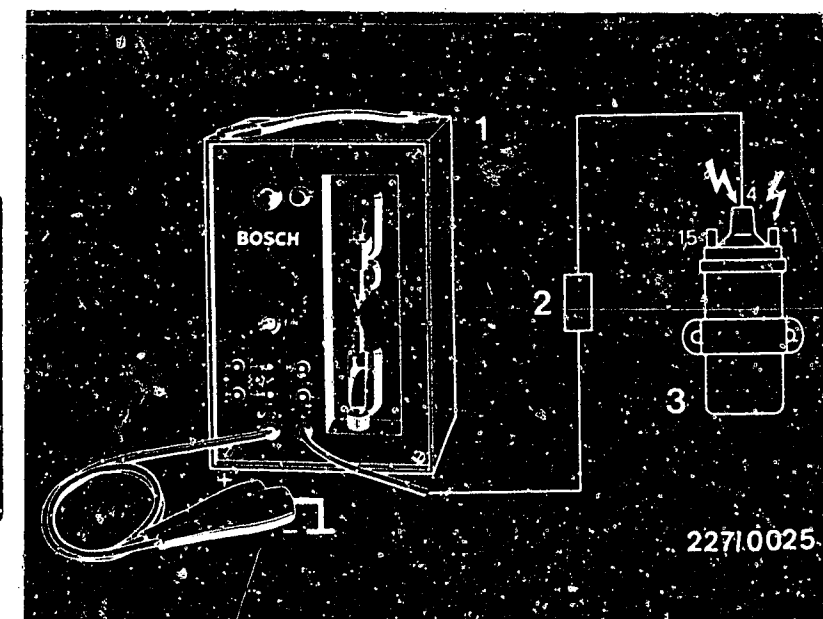
Primary signal present or ignition sparks across spark gap?

yes

Continued on B 11/B 12

If no primary signal or no ignition spark, continue testing at D 1.

Tests from B 11 onwards not necessary.



1 = Spark gap  
2 = 5 k $\Omega$  sleeve-type suppressor  
3 = ignition coil

Dangerous-voltage arrows:  
Caution, 400 V ... 25 kV

**B9**

Trouble-shooting program

Opel

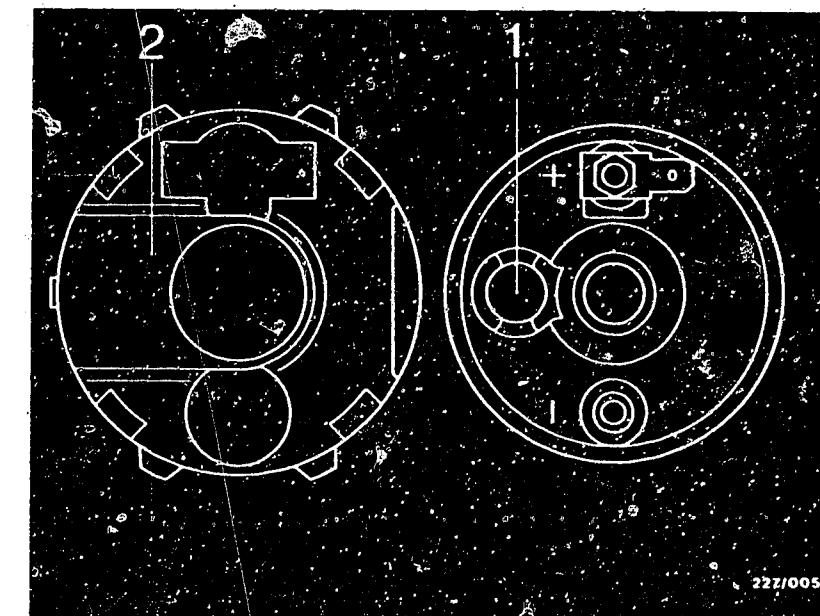
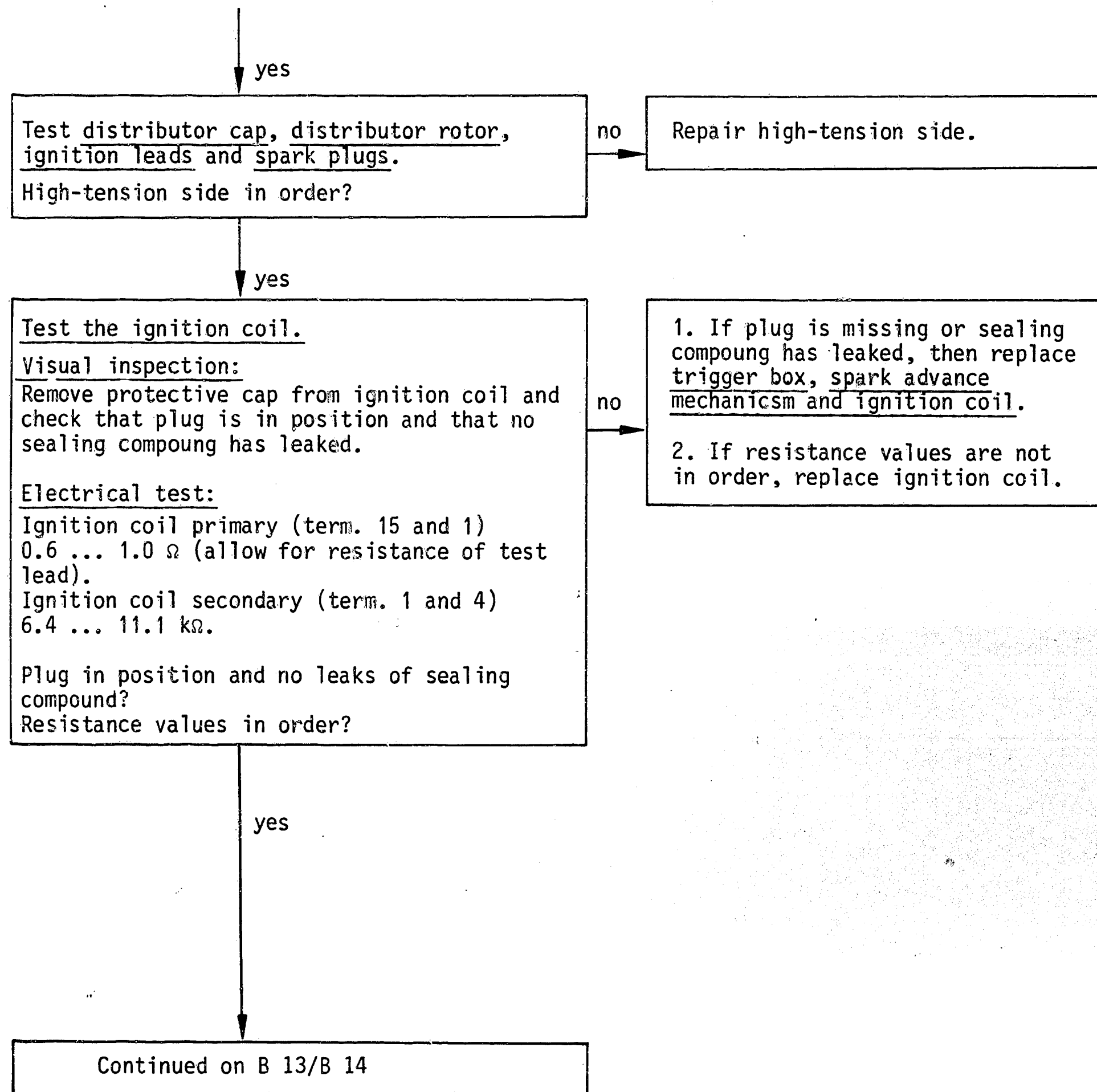


**B 10**

Trouble-shooting program

Opel





1 = Plug  
2 = Protective cap

**B 11**

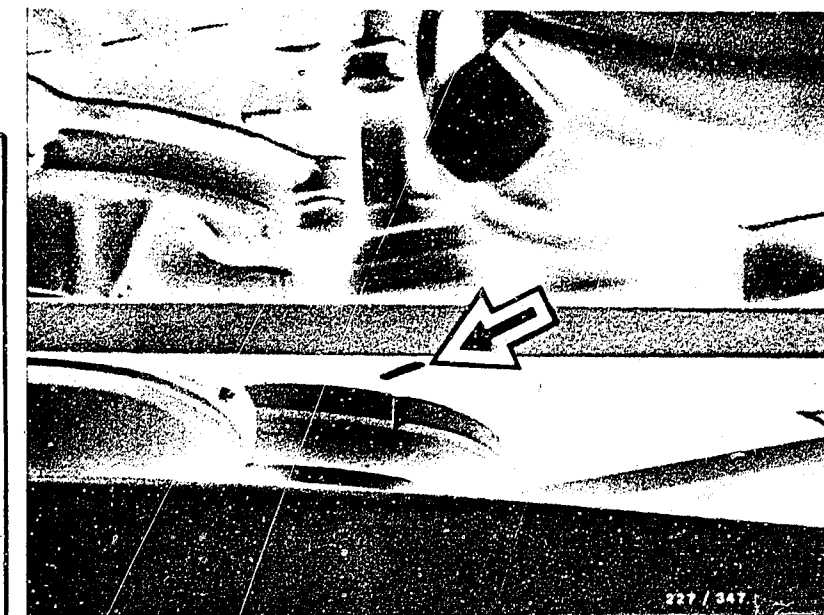
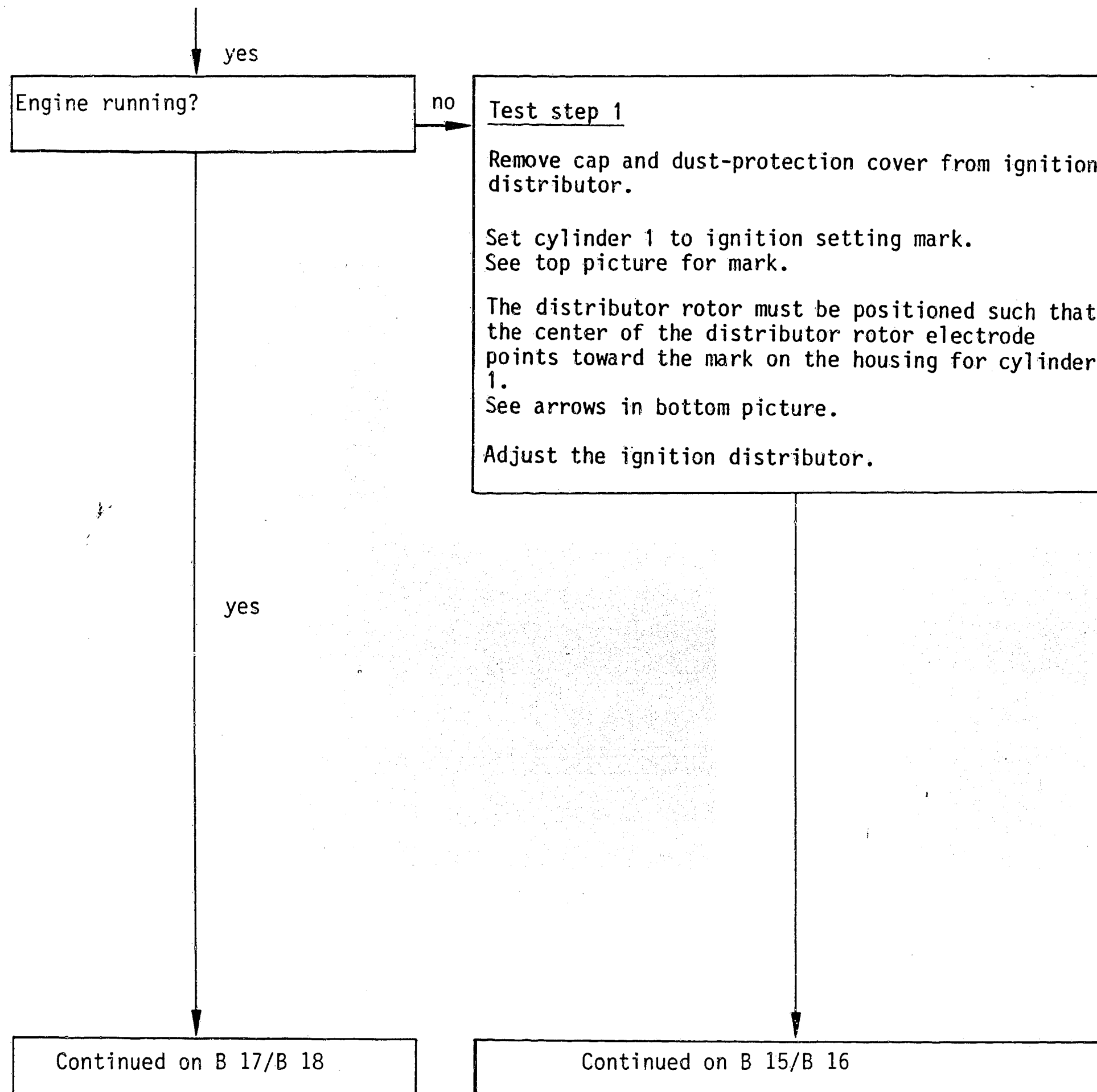
Trouble-shooting program  
Opel



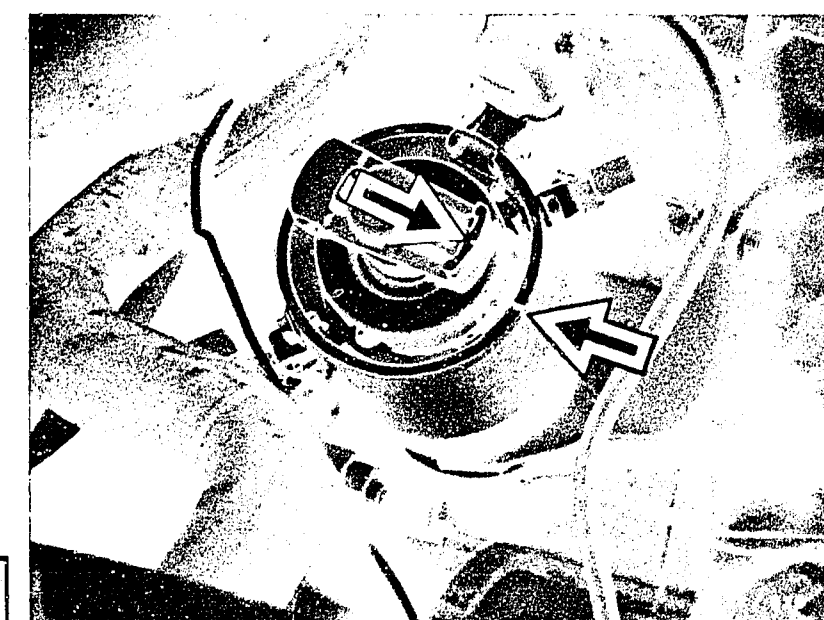
**B 12**

Trouble-shooting program  
Opel





Ignition timing mark (10° BTDC)



**B 13**

Trouble-shooting program

Open



**B 14**

Trouble-shooting program

Open



Continued

Test step 2

Disconnect negative and positive cables from battery. Push wire clip off trigger box plug and disconnect plug. Switch on ignition.

1. Test for contact resistance in cable from positive battery terminal to trigger box term. 4 including cables from negative battery terminal to trigger box plug term. 2. Total contact resistance max.  $0.3\ \Omega$  (make allowance for resistance of test lead).

Eliminate contact resistance.

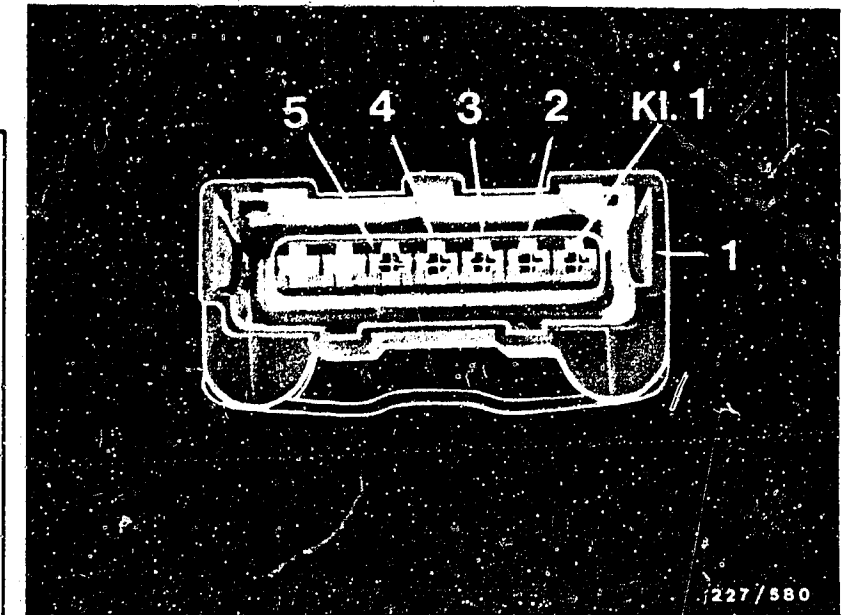
2. Test for contact resistance in cables from positive battery terminal to ignition coil term. 15 and in cable from ignition coil term. 1 to trigger box plug term. 1. Total contact resistance max.  $0.3\ \Omega$  (make allowance for resistance of test lead).

Eliminate contact resistance.

If test steps 1 and 2 are in order, replace trigger box.

yes

Continued on B17/B18



1 = Trigger box plug

**B 15**

Trouble-shooting program  
Opel



**B 16**

Trouble-shooting program  
Opel





yes

Test basic ignition timing.  
(If the indication of engine speed on the testers is clearly incorrect, connect in a series resistor).

Bring engine to operating temperature  
(engine oil  $> +60^{\circ}\text{C}$ ).

Switch off consuming devices (lights, etc.).  
Disconnect plug from throttle valve switch  
and connect short-circuiting device KDZS  
0003 to disconnected plug. See top  
illustration. Operate engine at idling  
speed.

(Manually shifted transmission  $800 \pm 25 \text{ min}^{-1}$ ,  
automatic transmission  $700 \pm 25 \text{ min}^{-1}$ ).

Aim a stroboscope at the timing marks.  
The mark on the crankshaft pulley must co-  
incide with the bar on the timing case.

The mark corresponds to  $10^{\circ}$  crankshaft angle  
BTDC. See arrow in lower illustration.

Check: Operate engine at approx.  $2000 \text{ min}^{-1}$

The timing marks must still coincide.

Basic ignition timing correct?

no

Loosen ignition distributor mount-  
ing and turn ignition distributor  
so that marks coincide ( $10^{\circ}$  BTDC)



1 = Short-circuiting device  
KDZS 0003

2 = Throttle valve switch plug

yes

Continued on B19/B20



**B17**

Trouble-shooting program

Open



**B18**

Trouble-shooting program

Open



yes

Disconnect short-circuiting device KDZS 0003 from throttle valve switch plug. Connect plug to throttle valve switch.

yes

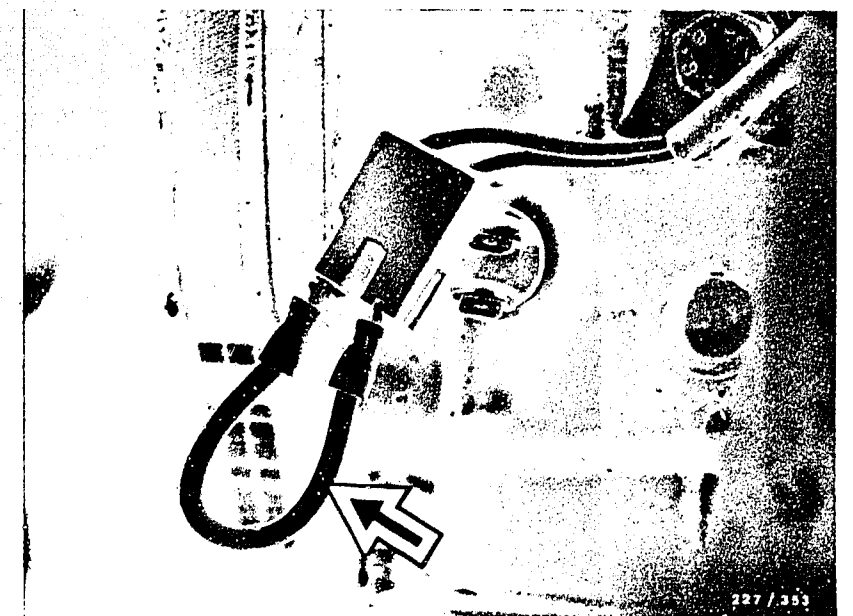
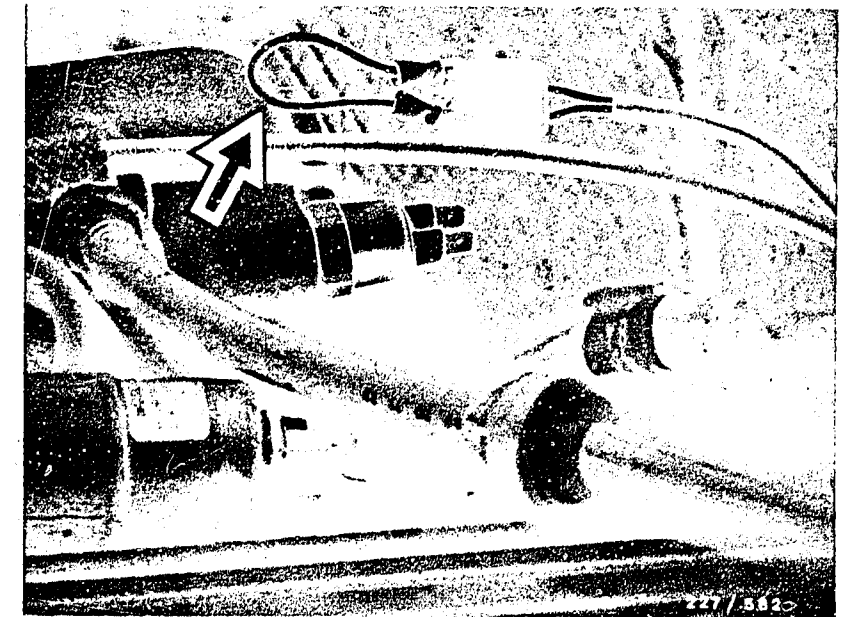
Test control line for characteristic control.

Disconnect temperature sensor switch and short the two terminals with an auxiliary cable. See arrow in lower illustration.

Disconnect the oil temperature switch plug and short the two terminals with an auxiliary cable. See arrow in lower illustration.

yes

Continued on B21/B22



**B 19**

Trouble-shooting program

0pe1



**B 20**

Trouble-shooting program

0pe1

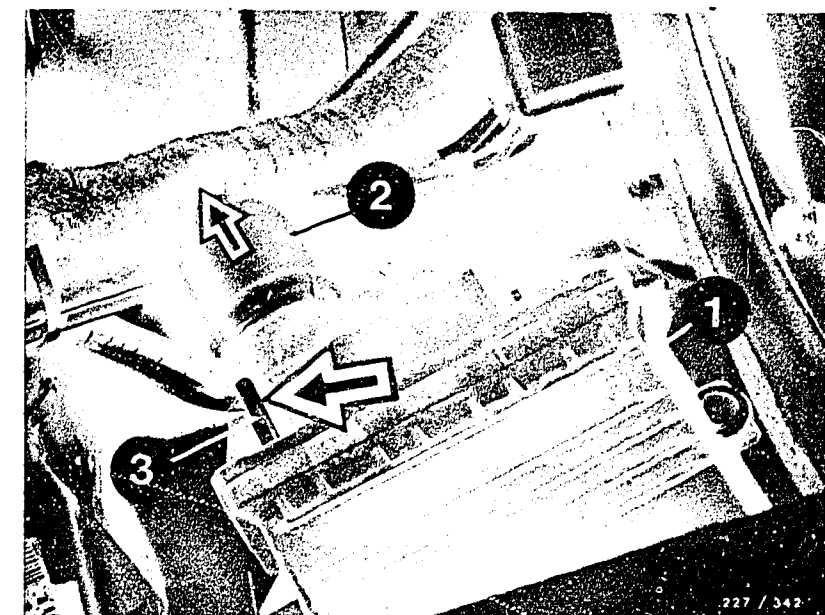


yes

Remove spark advance mechanism and disconnect spark advance mechanism plug. See arrow in top illustration. Connect voltmeter to spark advance mechanism plug term. 3 (+) and term. 7 (-). Switch on the ignition. The voltmeter must indicate approximately battery voltage. Voltage value in order?

no

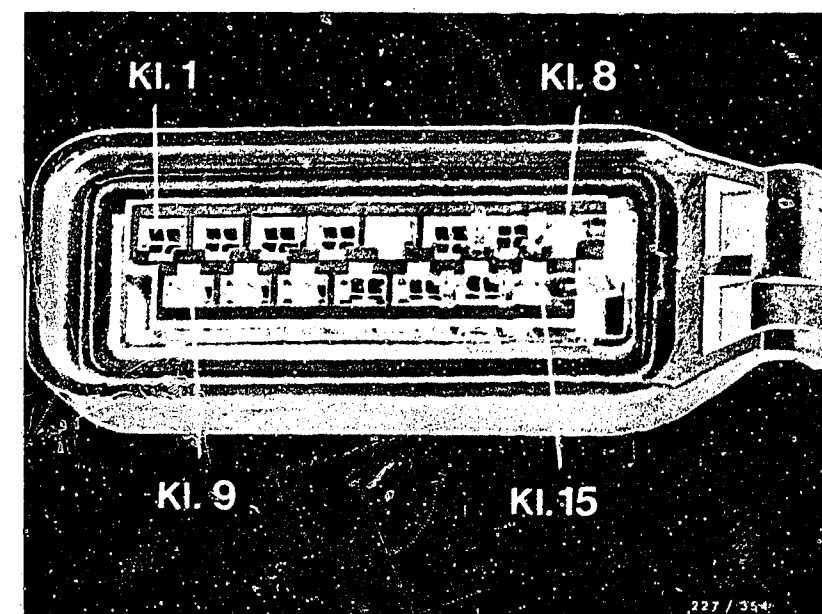
Check cable from spark advance mechanism plug term. 7 to temperature sensor switch via oil temperature switch plug for open circuits, including ground connection. Eliminate open circuit.



- 1 = Spark advance mechanism
- 2 = Spark advance mechanism plug
- 3 = Lock

yes

Continued on B23/B24



**B21**

Trouble-shooting program

Open



**B22**

Trouble-shooting program

Open



yes

Test temperature sensor.

Disconnect temperature sensor plug. Connect ohmmeter to both terminals of temperature sensor, using test prods. See illustration.

Ohmmeter reads as follows:

> approx. 17°C = approx. 0  $\Omega$

(sensor closed)

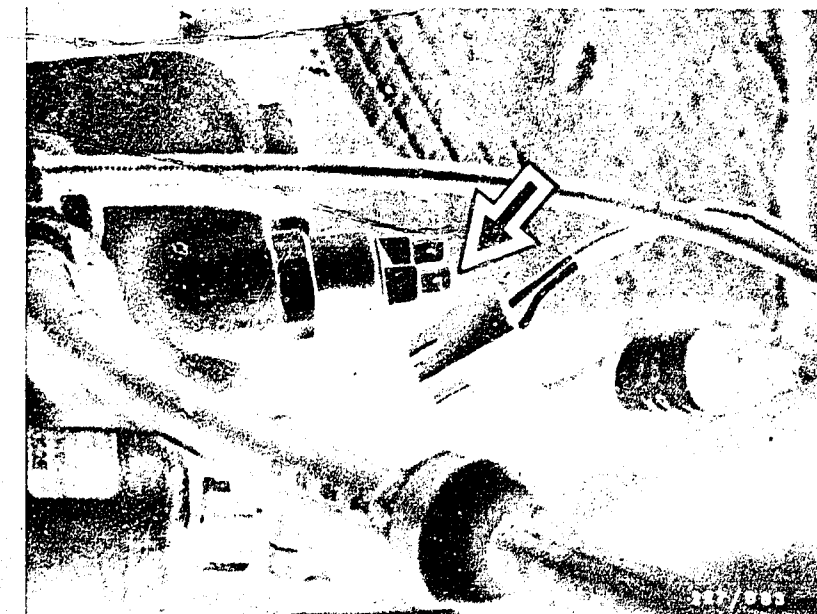
< approx. 17°C = open circuit ( $\infty$ )

(sensor open)

Resistance value in order?

no

Replace temperature sensor.



yes

Continued on C1/C2

**B23**

Trouble-shooting program

Open

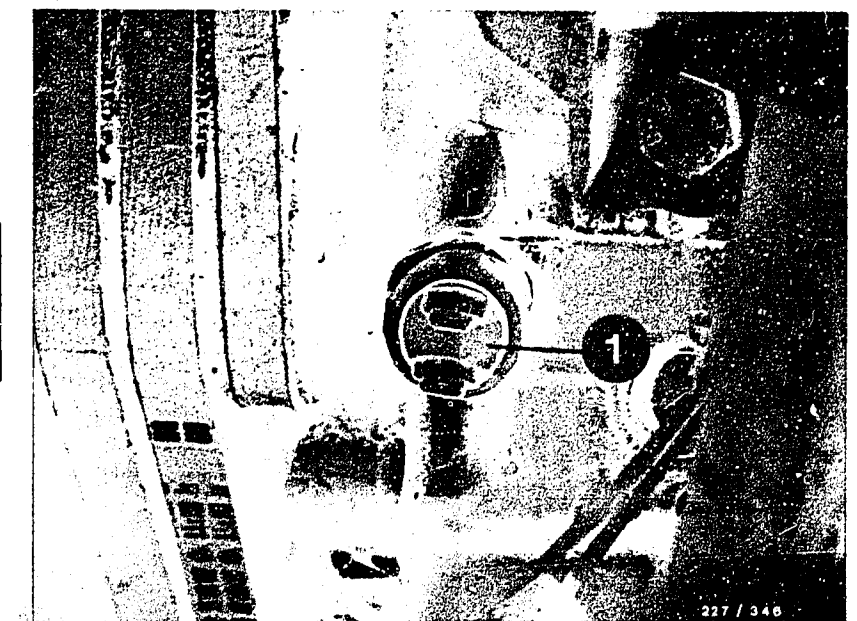
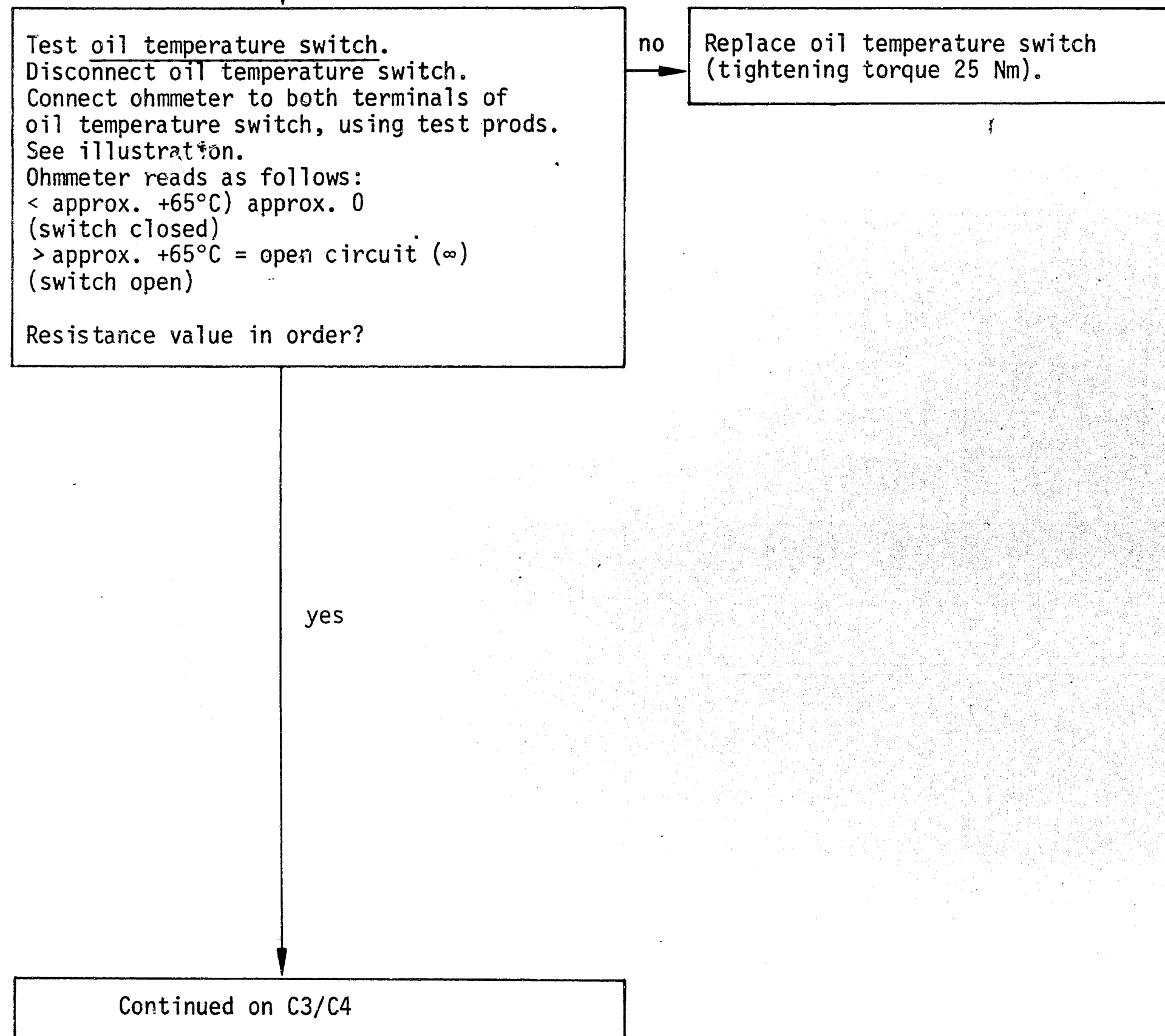


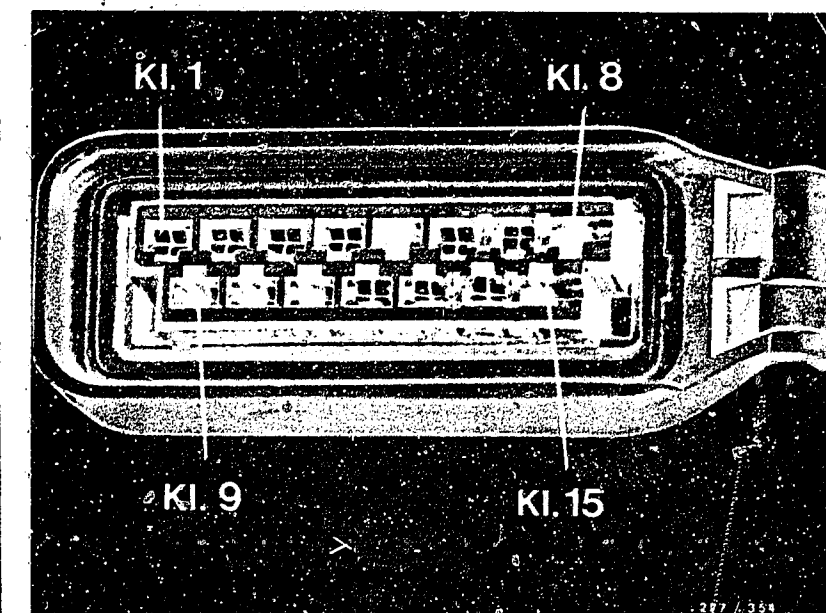
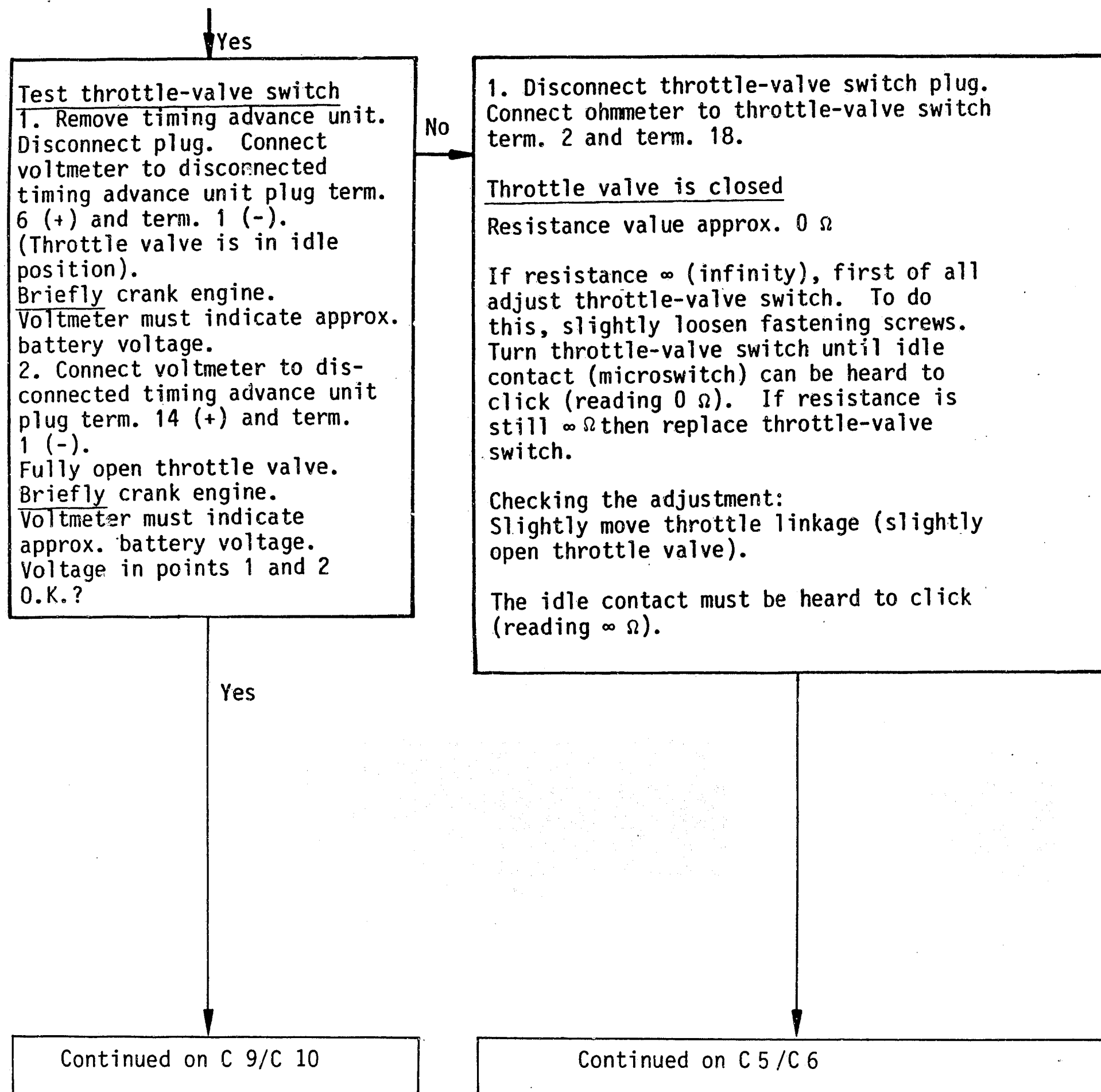
**B24**

Trouble-shooting program

Open

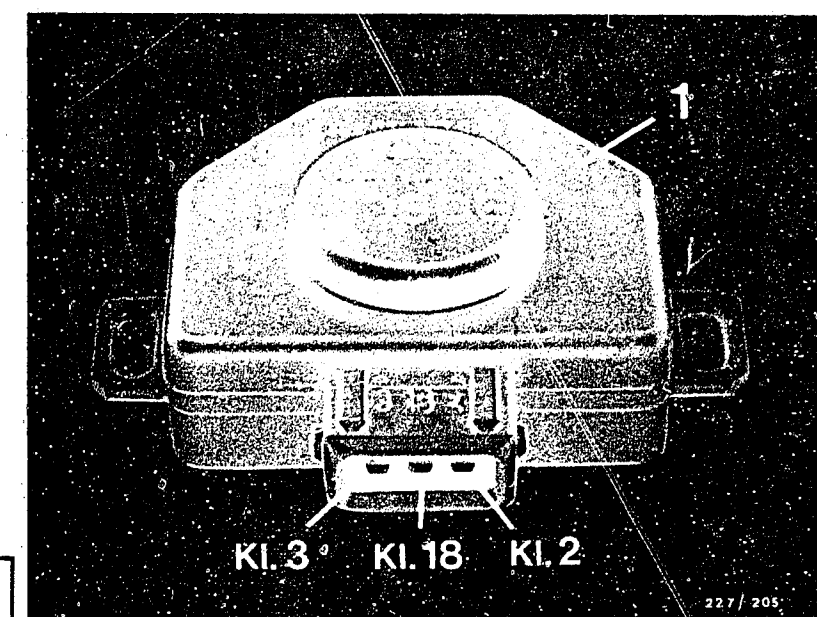






Timing advance unit plug

1 = Throttle-valve switch





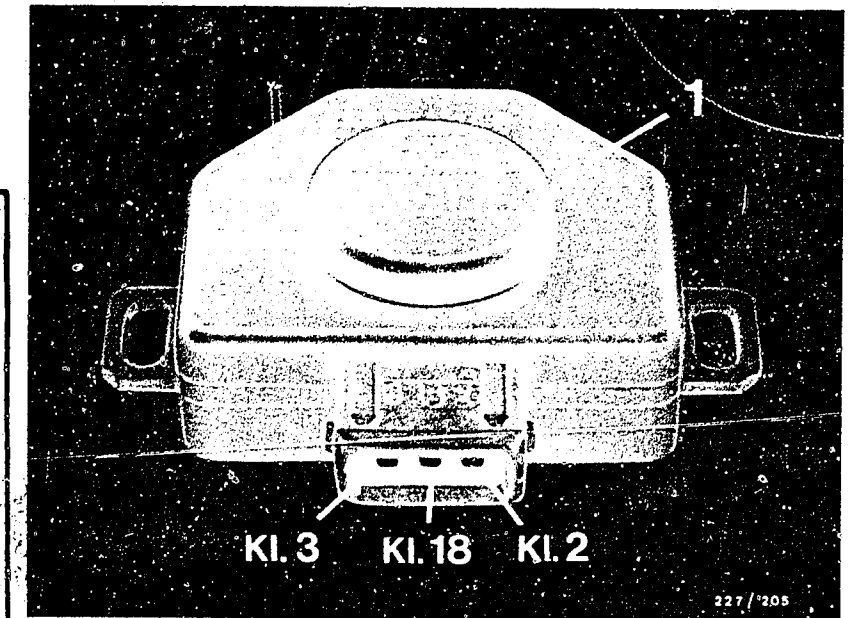
Continued

3. Connect ohmmeter to throttle-valve switch  
term. 3 and term.18

Open throttle valve fully

Resistance approx.  $0\Omega$

If resistance infinity ( $\infty\Omega$ ) replace throttle-  
valve switch.



1 = Throttle-valve switch

Yes

Continued on C 9/C 10

Continued on C 7/C 8

**C5**

Trouble-shooting program

Open



**C6**

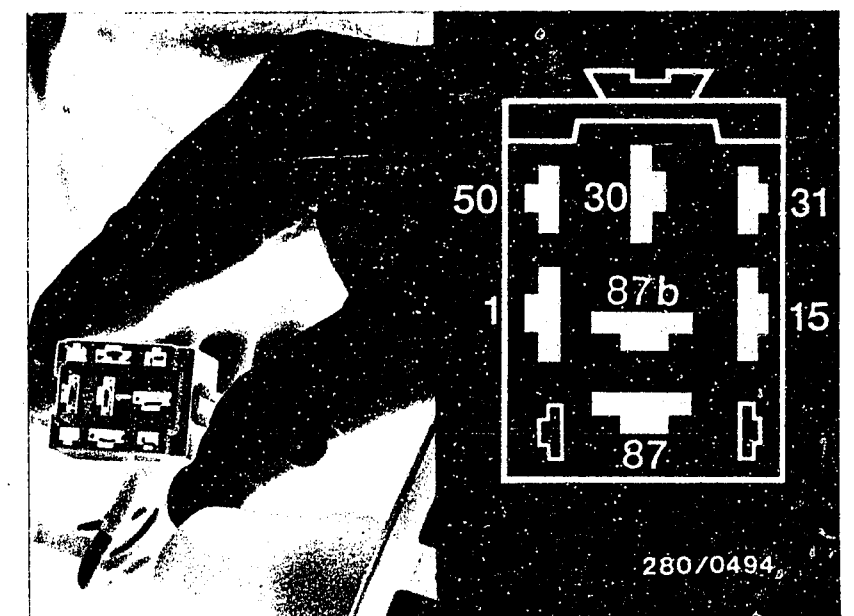
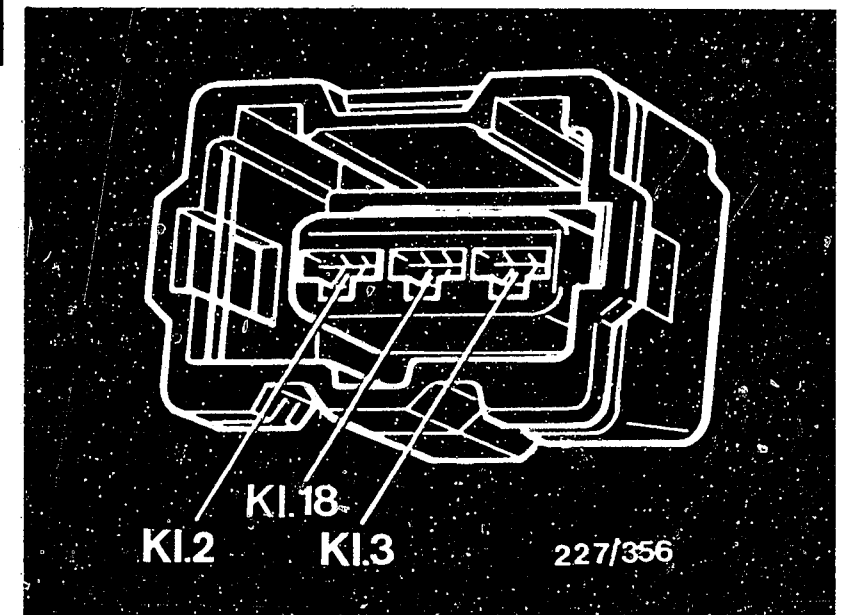
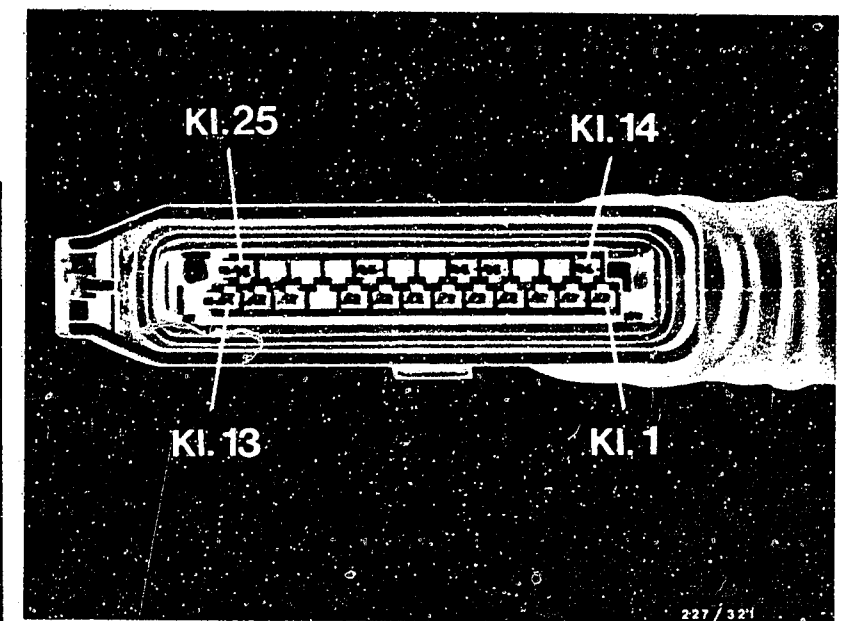
Trouble-shooting program

Open



Continued

If approx.  $0\ \Omega$  was measured in test steps 1 and 2, then test for open circuit in lead connection from timing advance unit plug term. 6 and term. 14 (see top picture) to throttle-valve switch plug term. 2 and term. 3 (see center picture) and in lead from throttle-valve switch plug term. 18 to L-Jetronic control-relay plug term. 87 (see bottom picture). Eliminate open circuit.



yes

Continued on C 9/C 10

**C7**

Trouble-shooting program

Open



**C8**

Trouble-shooting program

Open



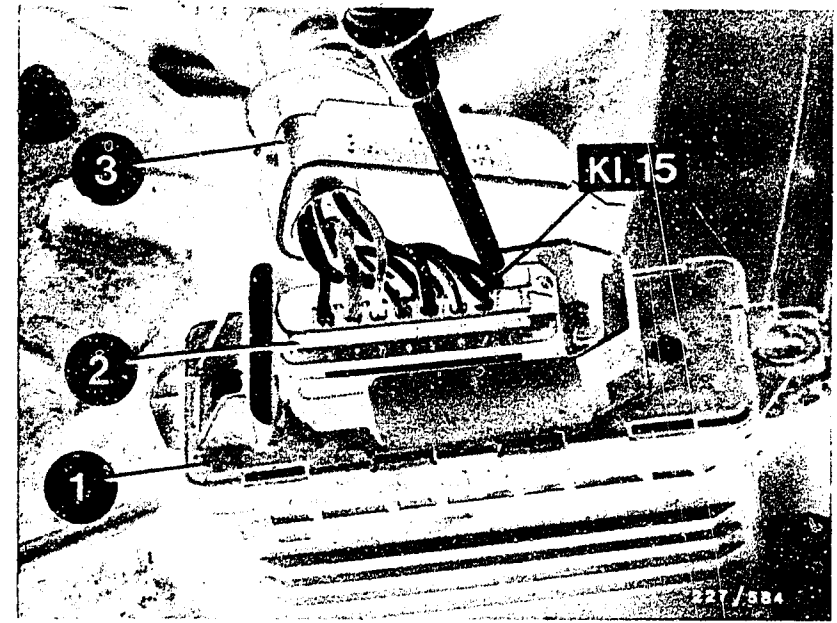


yes

Test load signal.  
Disconnect spark advance mechanism plug and push back handle cover after unscrewing mounting screw and removing rubber cover. See top illustration.  
Reconnect spark advance mechanism plug and connect up dwell angle tester with the green clip on term. 15 (see top illustration) and the yellow clip on the positive battery terminal.  
Operate engine at idling speed. Read and note dwell angle value.  
Briefly depress accelerator pedal fully and note dwell angle reading. The dwell angle previously shown must change noticeably.  
Does the dwell angle change?

no

Test the cable from the spark advance mechanism plug term. 15 to the L-Jetronic control unit plug term. 6 for open circuit and short to ground.  
Eliminate open circuit or short to ground.  
If no open circuit or short to ground is detected, replace L-Jetronic control unit.

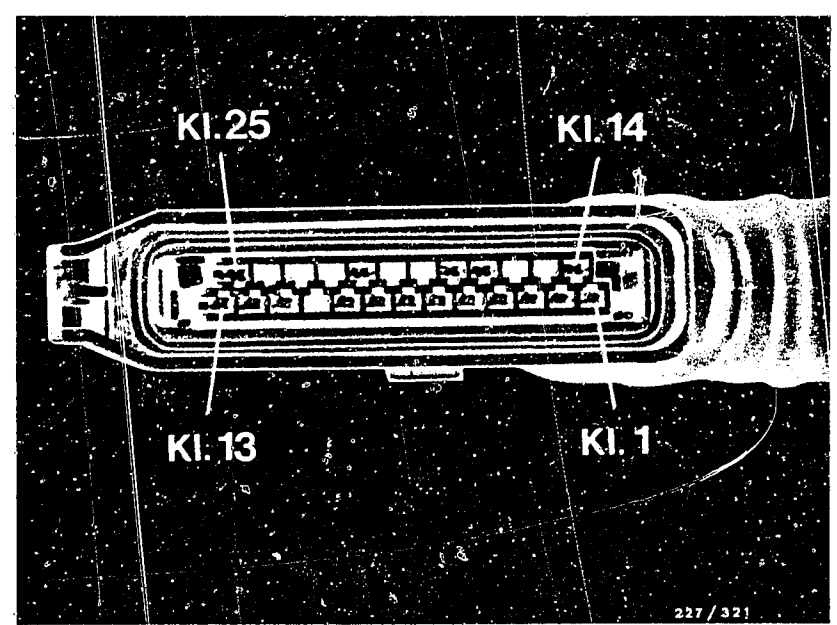


- 1 = Spark advance mechanism
- 2 = Plug
- 3 = Handle cover

yes

Continued on C11/C12

L-Jetronic control unit plug



yes

Check power supply from ignition trigger box.

Take out the windshield washer reservoir. Unscrew the ignition coil and the cooling plate. Push back the rubber sleeve on the trigger box plug. See figure at top. Connect voltmeter to trigger box plug Term. 4 (+) and Term. 2 (-). Run engine at idle. The voltage measured must be battery voltage and must not be more than 1 V less than battery voltage.

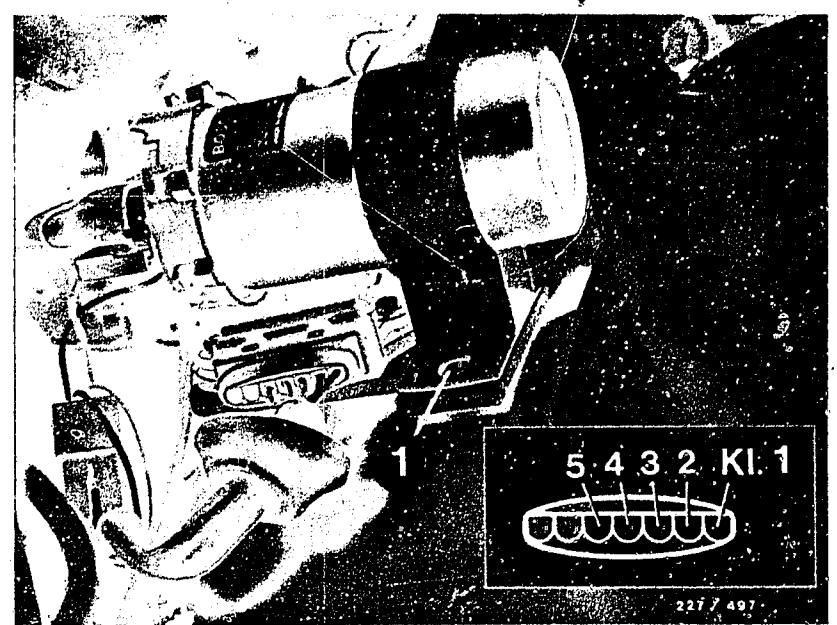
Is the value for voltage in order?

No

Disconnect negative and positive cables from battery. Remove trigger-box plug. Switch on ignition.

Check for contact resistance in cables from positive battery terminal to trigger-box plug term. 4 including cables from negative battery terminal to trigger-box plug term.2. Total contact resistance max. 0.3  $\Omega$  (make allowance for resistance of test lead).

Eliminate contact resistance.



1 = Ignition coil with cooling plate

yes

Test ignition coil voltage supply

Connect voltmeter to ignition coil term.15 and negative battery terminal.

Allow engine to idle. Measured voltage must be at least 10 V.

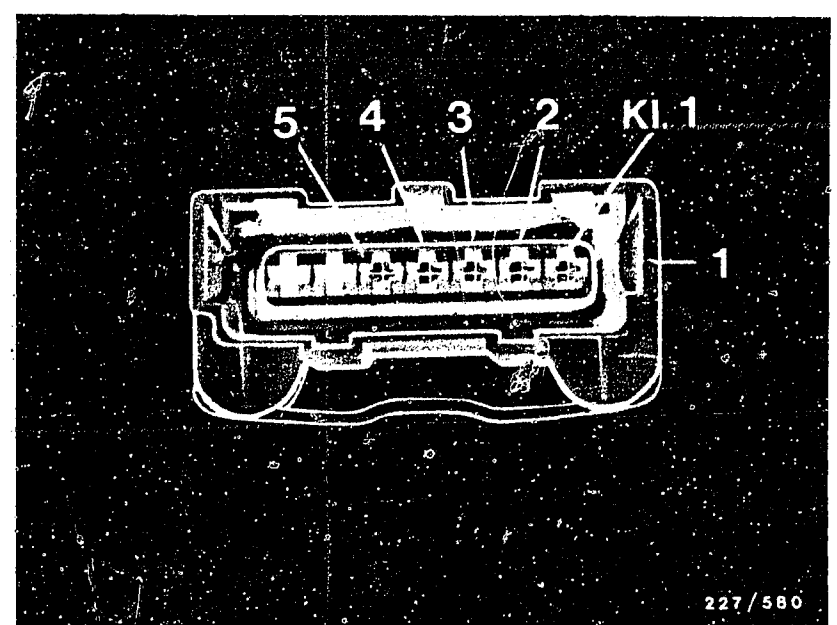
Voltage correct?

No

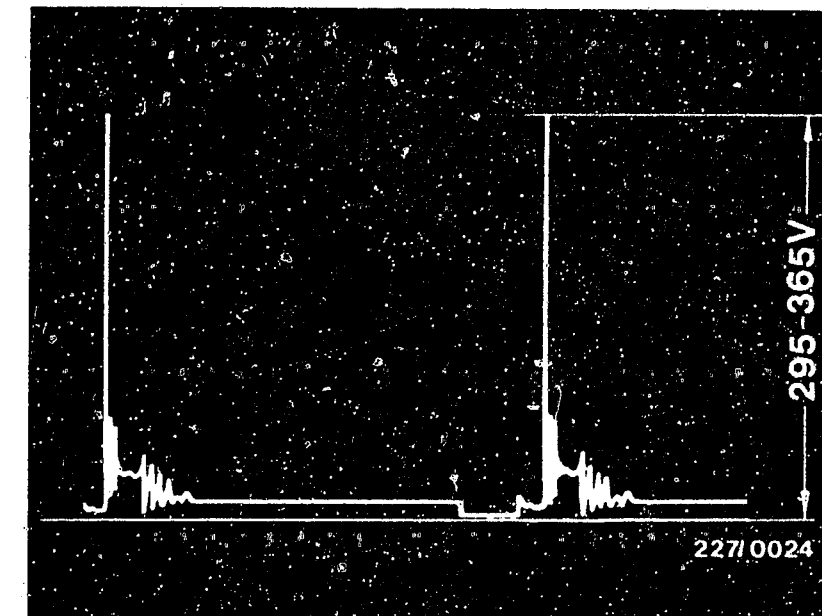
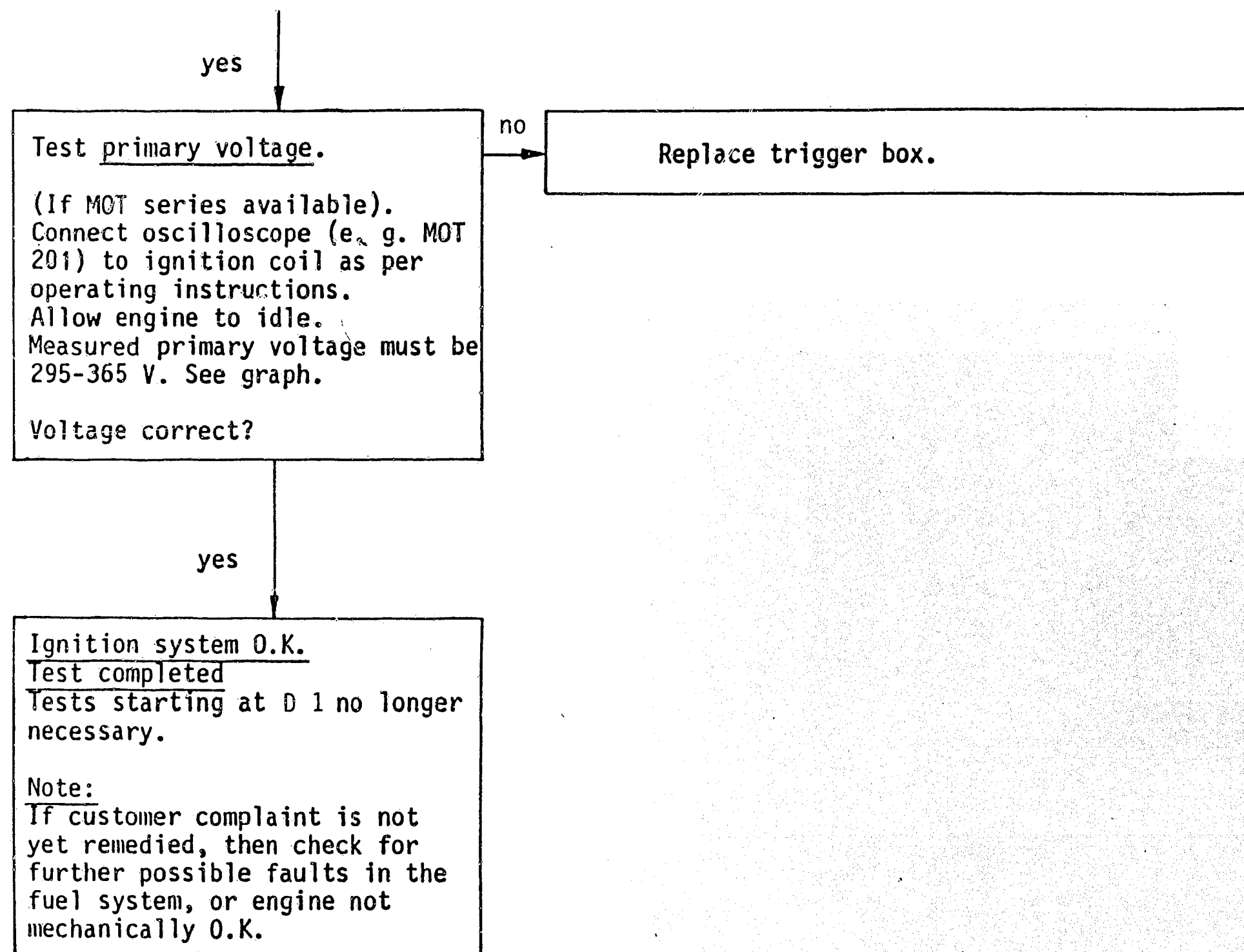
Disconnect positive cable from battery. Switch on ignition. Check for contact resistance in cables from positive battery terminal to ignition coil term.15. Contact resistance max. 0.3  $\Omega$ . (make allowance for resistance of test lead).

Eliminate contact resistance.

1 = Trigger-box plug



Continued on C 13/C 14



No primary signal or ignition spark.

(Continued from B9/B10)

yes

Test trigger box power supply.

Remove screen washer tank.

Press wire clip of trigger box plug and disconnect plug.

Connect voltmeter to trigger box plug between term. 4 (+) and term. 2 (-).

Switch on the ignition. The voltmeter must indicate battery voltage.

no

Test cables and connections between ignition/starter switch and trigger box plug term. 4 for open circuit, including ground cable term. 2. Eliminate open circuit.

yes

Test primary circuit.

Disconnect trigger box plug and connect voltmeter between term. 1 (+) and term. 2 (-). Switch on ignition. Voltmeter must indicate battery voltage.

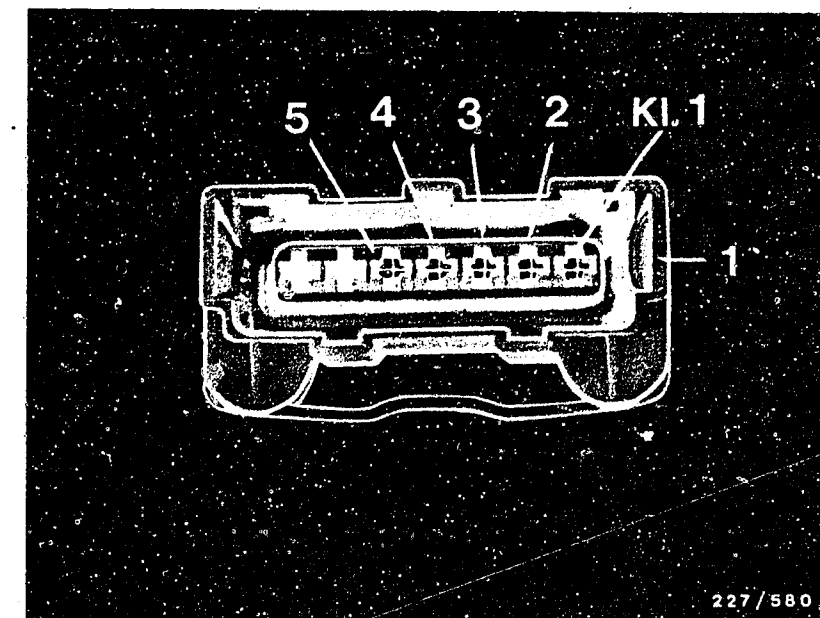
Voltage value in order?

no

Test supply cable from ignition/starter switch to ignition coil term. 15, primary winding of ignition coil and cable from ignition coil term. 1 to trigger box plug term. 1 for open circuit, including ground cable term. 2. Eliminate open circuit.

yes

Continued on D 3



1 = Trigger box plug

**D1**

Trouble-shooting program

Open



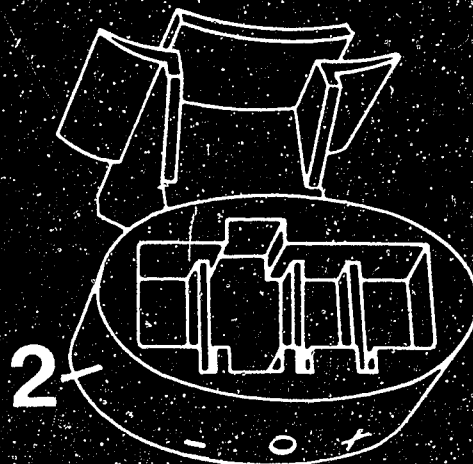
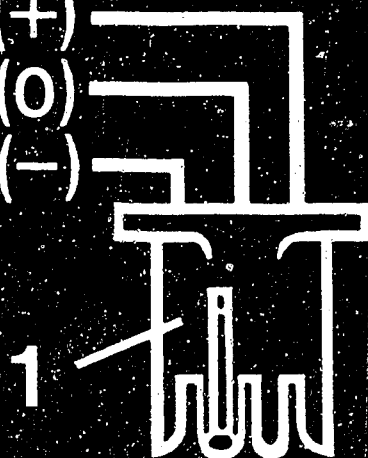
**D2**

Trouble-shooting program

Open



KI. 4(+)  
KI. 12(0)  
KI. 2(-)



227/357

1 = Ignition-distributor plug  
2 = Ignition-distributor socket

yes

Test connector and socket of ignition distributor.

Visual examination:

Remove the ignition-distributor connector (see picture) and check contacts for oxidation and correct latching (remedy defects).

Reconnect ignition-distributor connector. If customer complaint not remedied, continue testing.

yes

Continued on D4/D5

**D3**

Trouble-shooting program

Opel



yes

Test pulse generator voltage supply.

Plug on trigger-box plug. Push back rubber sleeve of ignition-distributor connector.

Connect voltmeter with test prods to ignition distributor plug term. 4 (+) and term. 2 (-).  
Switch on ignition.

Voltmeter must indicate a voltage of > 10V.

Voltage correct?

no

Disconnect trigger-box plug, ignition distributor plug and timing-advance unit plug.

Connect ohmmeter with test prods one after the other.

1. Ignition-distributor plug      Spark advance mechanism plug

Term. 4                      and term. 4  
Term. 2                      and term. 2

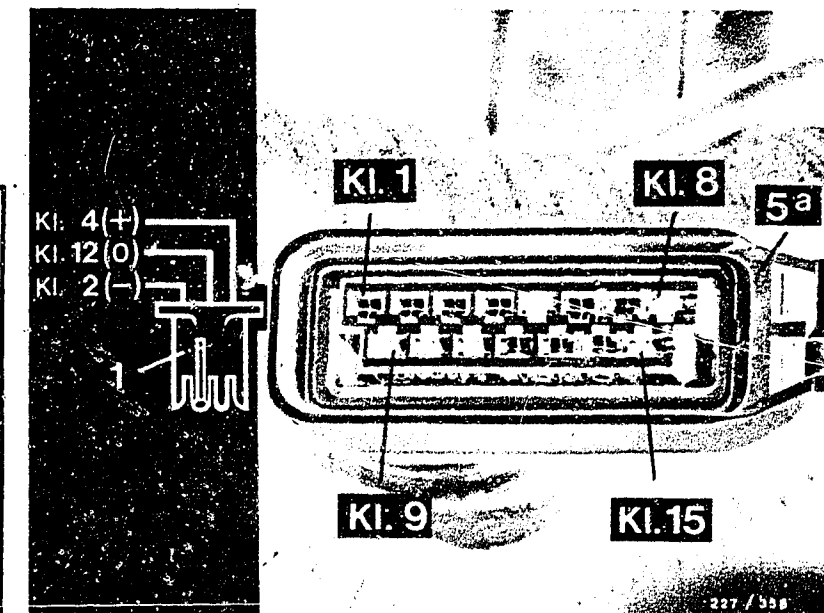
In each case ohmmeter must indicate approx. 0  $\Omega$  (continuity). Eliminate open circuit.

2. Spark advance mechanism plug      Trigger-box plug

Term. 1                      and term. 3  
Term. 3                      and term. 4

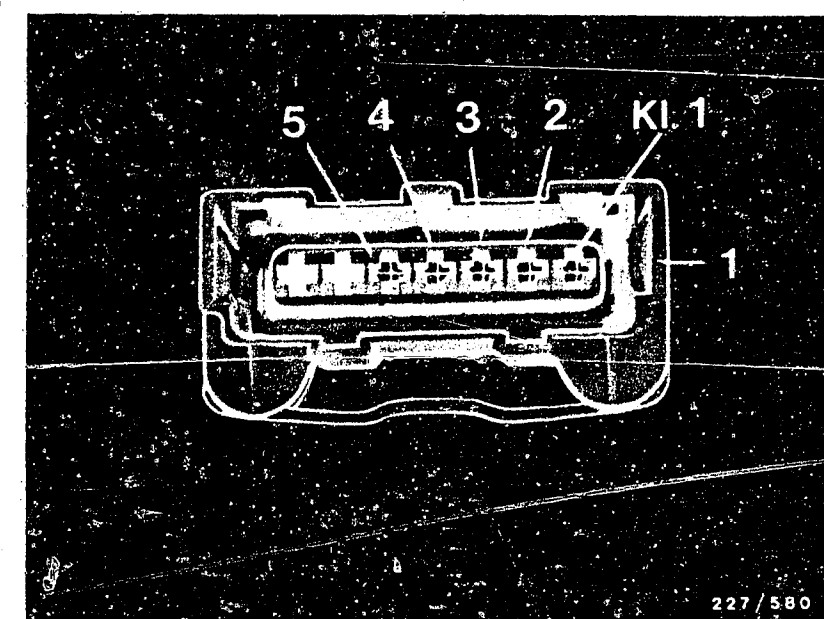
In each case ohmmeter must indicate approx. 0  $\Omega$  (continuity). Eliminate open circuit.

If there was no open circuit in Points 1 and 2, replace ignition timing unit.



1 = Ignition distributor plug  
5a = Spark advance mechanism plug

1 = Trigger-box plug



Continued on D 6 / D 7

**D4**

Trouble-shooting program

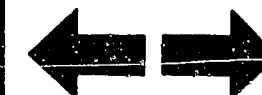
Open



**D5**

Trouble-shooting program

Open



yes

### Test operation of pulse generator.

Trigger-box plug, ignition distributor plug and timing-advance unit plug connected.

Push back rubber sleeve of ignition-distributor connector.

Connect oscilloscope as per operating instructions with program switch in "special" position.

For example, MOT 201:

Red clip with test prod to ignition-distributor connector term. 12 (measured signal).

Black clip to ground.

Start engine.

The oscilloscope must show a rectangular pulse. See graph.

Rectangular pulse present?

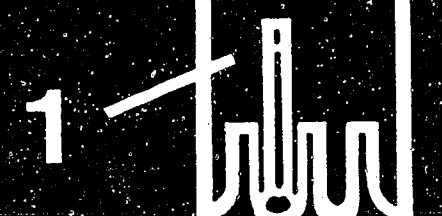
no

Replace pulse generator/ignition distributor.

yes

Continued on D 8 / D 9

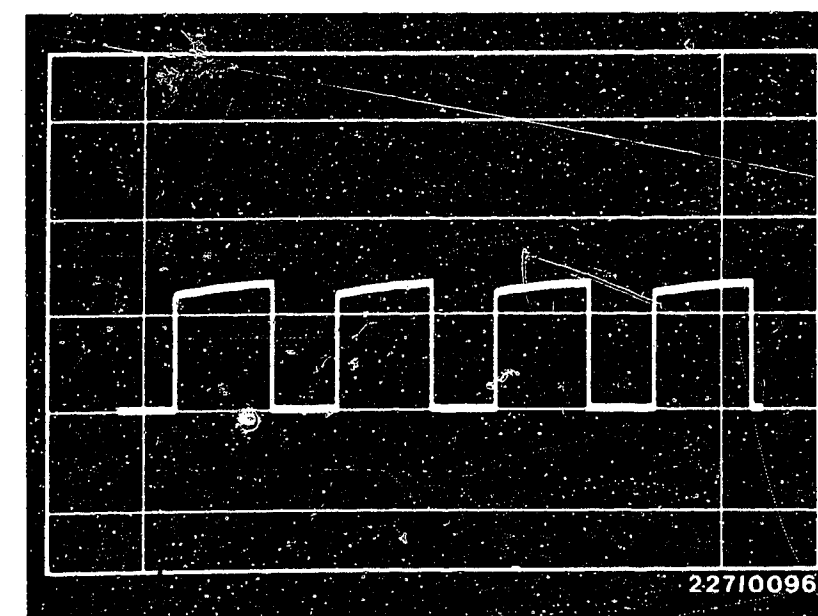
KI. 4(+)  
KI. 12(0)  
KI. 2(-)



227/359

1 = Ignition distributor plug

Rectangular pulse



22710096

**D6**

Trouble-shooting program

Opel



**D7**

Trouble-shooting program

Opel

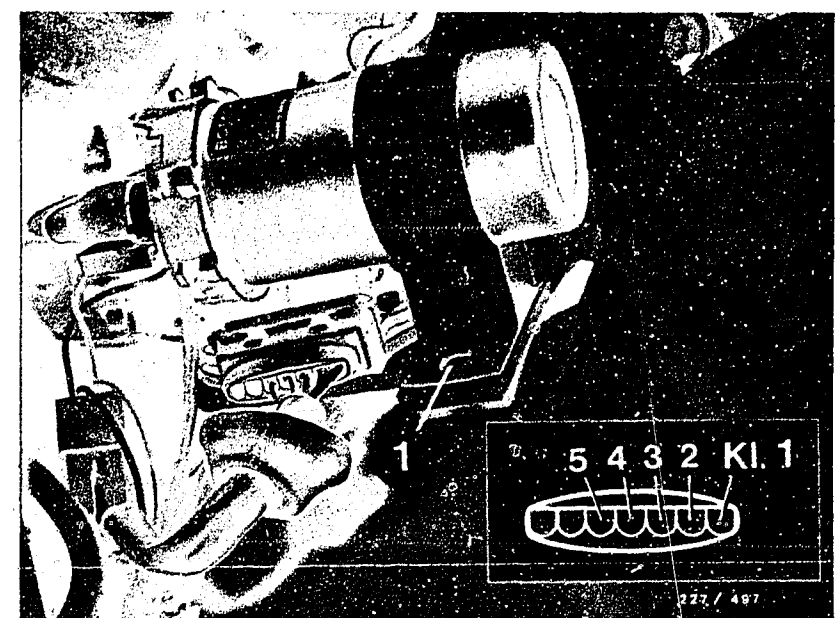


yes

Test spark advance mechanism.  
Connect up trigger box plug, ignition distributor plug and spark advance mechanism plug.  
Remove screen washer tank. §  
Unscrew ignition coil and heat sink.  
Push back rubber sleeve of trigger box plug.  
  
Connect up oscilloscope in accordance with operating instructions, with program switch set to "Special".  
  
E.g. MOT 201:  
  
Red terminal with test prods to trigger box plug term. 5 (measuring signal).  
  
Black terminal to ground.  
  
Start engine.  
  
Oscilloscope must display rectangular pulse. See lower illustration.  
  
Rectangular pulse present?

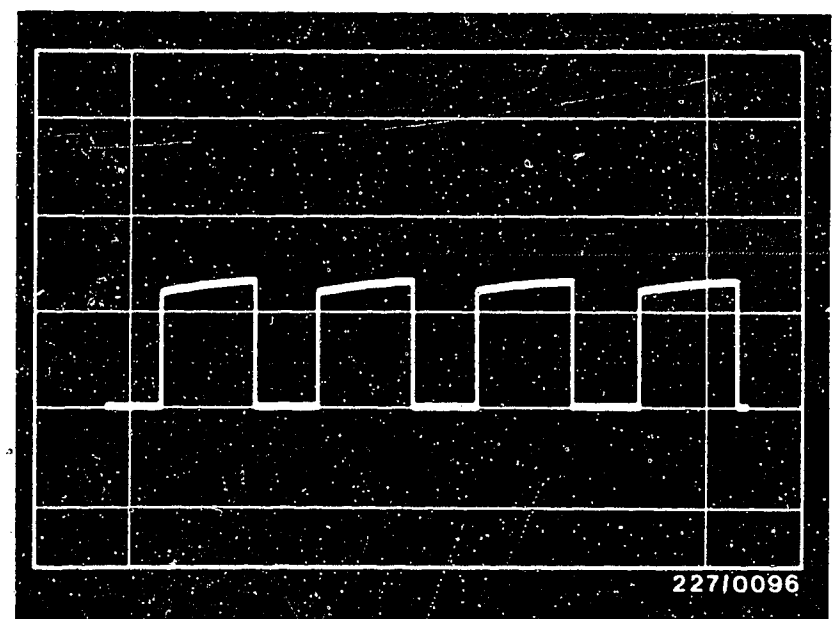
no

Disconnect trigger box plug, ignition distributor plug and spark advance mechanism plug.



1 = Ignition coil and heat sink

Rectangular pulse



yes

Continued on D 12/D 13

Continued on D 10/D 11



Continuation

Connect ohmmeter to each of the following in succession:

Ignition distributor plug

Spark advance mechanism plug

Term. 12

and

Term. 12

Spark advance mechanism plug

Trigger box plug

Term. 13

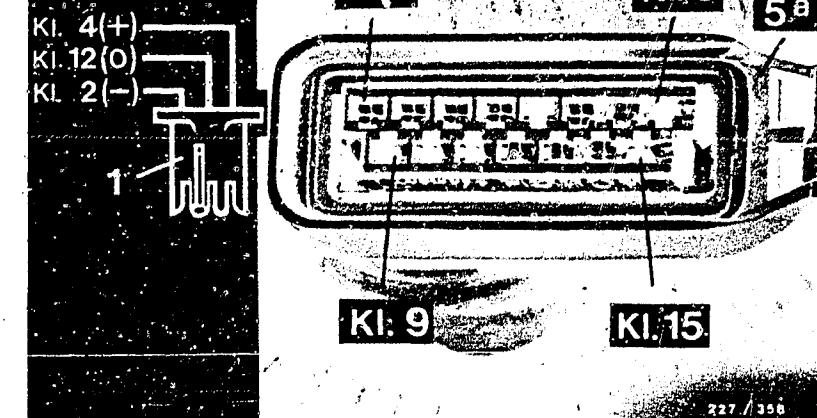
and

Term. 5

Ohmmeter must indicate approx. 0  $\Omega$  (continuity) in each case.

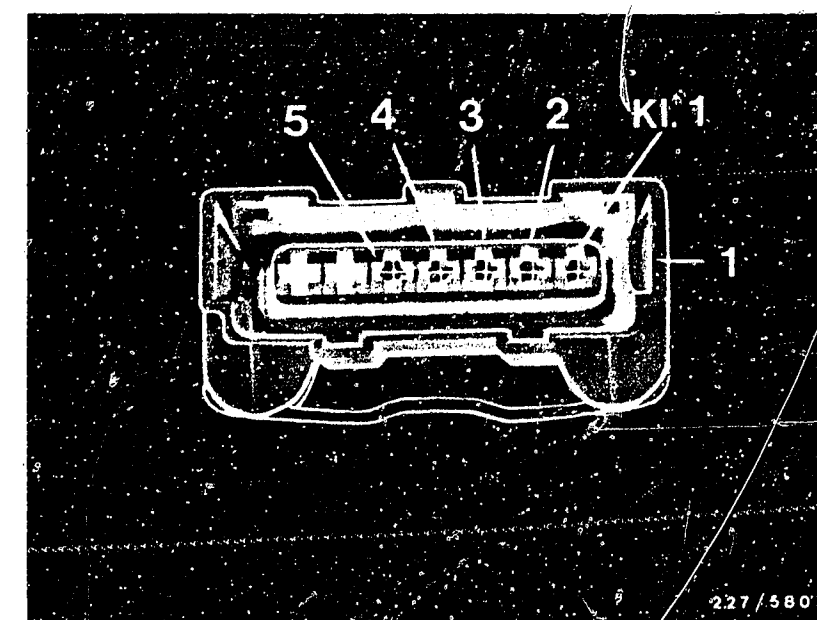
Eliminate any open circuit.

If no open circuit has been detected, replace spark advance mechanism.



1 = Ignition distributor plug  
5a = Spark advance mechanism plug  
KI. = Term.

1 = Trigger box plug



yes

Continued on D12/D13

**D10**

Trouble-shooting program  
Open



**D11**

Trouble-shooting program  
Open



yes

### Test rotational-speed signal.

Remove L-Jetronic control unit and disconnect plug.

Connect up oscilloscope in accordance with operating instructions with program switch set to "Special":

E.g. MOT 201:

Red terminal with test lead to L-Jetronic control unit plug term. 1 (measuring signal). See top illustration.

Black terminal to ground.

Start engine.

Oscilloscope must display rectangular pulse. See center illustration.

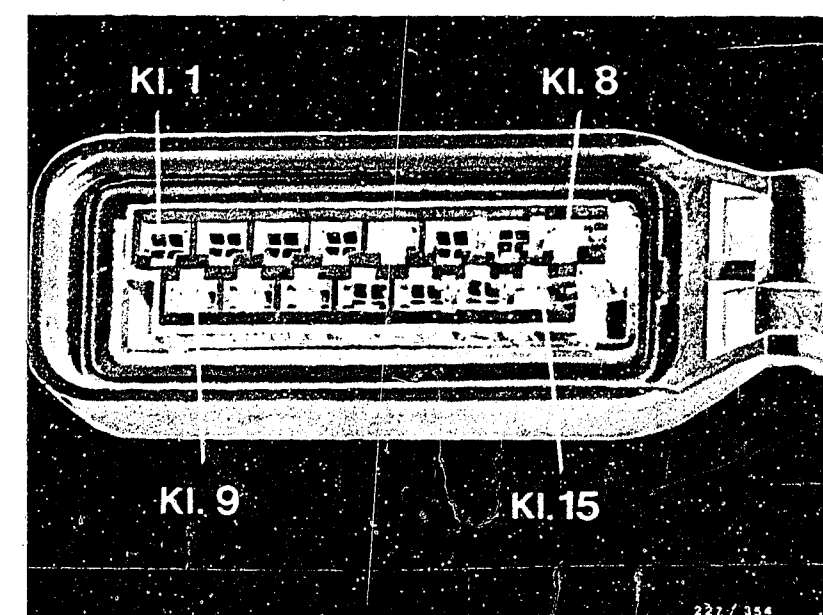
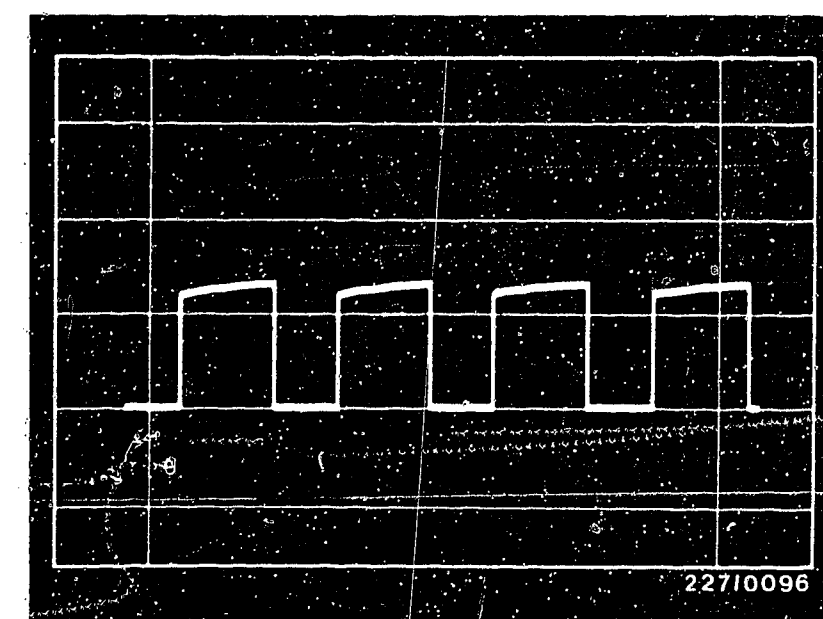
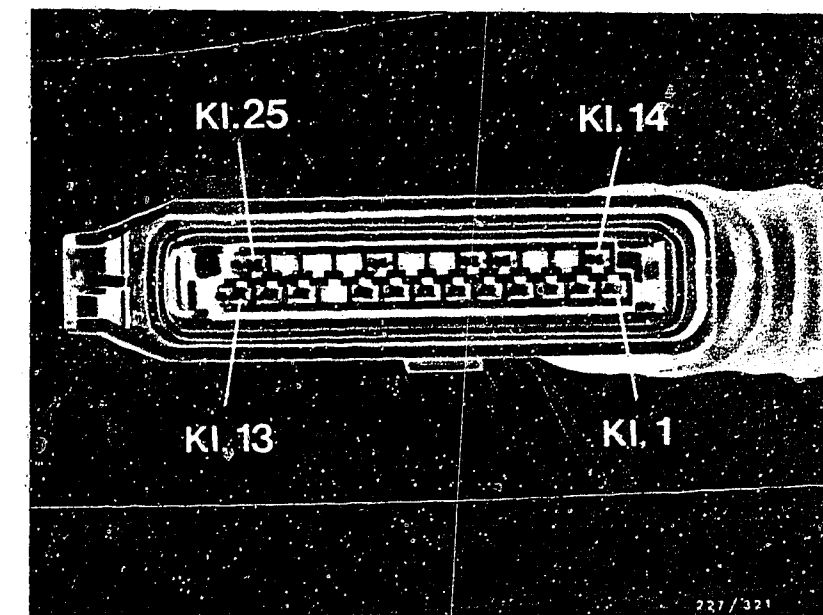
Rectangular pulse present?

no

Test cable from spark advance mechanism plug term. 5 (lower illustration) to L-Jetronic control unit plug term. 1 (top illustration) for open circuit. Eliminate open circuit.

yes

Continued on D14/D15



**D12**

Trouble-shooting program

Open



**D13**

Trouble-shooting program

Open



yes

### Test ignition coil.

#### Visual examination:

Remove protective cap from ignition coil and check whether plug (see picture) is in position and whether any sealing compound has escaped.

#### Electrical test:

Ignition coil primary (term. 15 and term. 1)  $0.6 \dots 1.0 \Omega$   
(make allowance for resistance of test lead).

Ignition coil secondary (term. 1 and term. 4)  $6.4 \dots 11.1 \text{ k}\Omega$

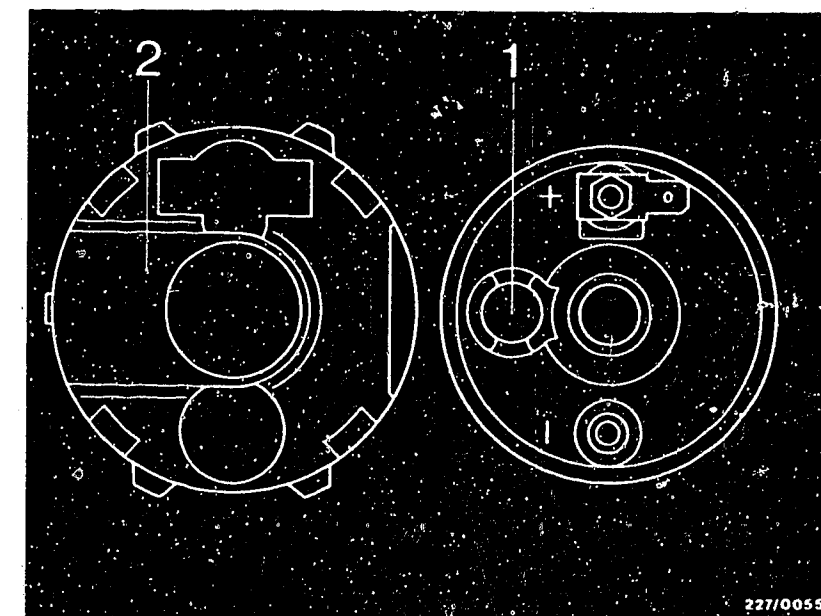
Plug in position? No sealing compound escaped?

Resistance value O.K.?

no

1. If plug is not in position and/or sealing compound has escaped, replace trigger-box, ignition timing unit and ignition coil.

2. If resistance values are not O.K., replace ignition coil.



1 = Plug  
2 = Protective cap

yes

Replace trigger box.

### Test completed.

Tests from B11 not necessary.

#### Note:

If customer complaint is not yet remedied, then check for further possible faults in the fuel system, or engine not mechanically O. K.

**D14**

Trouble-shooting program

Open



**D15**

Trouble-shooting program

Open



# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

22

Danger of Accident on Semi-conductor Ignition Systems

VDT-I-227/102 B

11.1976

Please be sure to pass this bulletin on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufactures starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" parts or contacts (whether on the primary side or the secondary side) can prove fatal.

In this connection we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems the ignition is to be switched off. Included in such work are the following operations:

- Connection of engine testing equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacement of ignition system parts (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.).

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), on terminals, and on test equipment.

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**N1**

Technical Bulletin

Opel

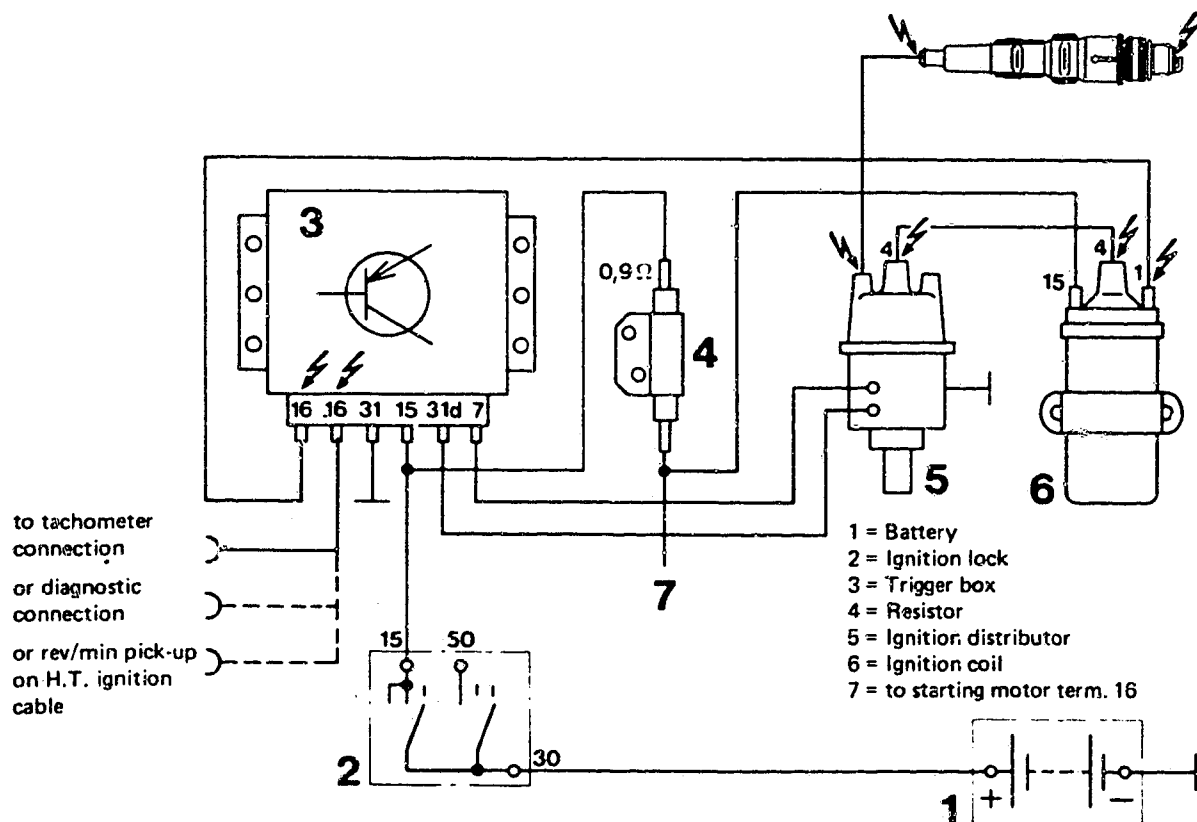


In addition, in the case of the capacitor-discharge ignition system (CDi), danger of accident is also present under the following circumstances:

- Operation of the trigger box without the ignition transformer.
- At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the danger points are marked with red high-voltage arrows. We would point out that all semi-conductor ignition systems, even the older ones, are to be regarded as dangerous in the sense as defined by this bulletin.

Please address any queries or comments concerning the contents of this publication to our representative in your country.



Terminal diagram

# After-sales Service

## Technical Bulletin

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EFFECTS OF ELECTRICAL AND ELECTRONIC  
SYSTEMS ON HEART PACEMAKERS

VDT-I-227/107 En

1.1981

e.g. ignition systems, Jetronic, Motronic, ABS

Please ensure without fail that this Bulletin is passed on to your employees for their attention!

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) listed the results.

The most important discoveries in this practice can be summarized from the examination report as follows:-

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.
2. With a stationary engine and the ignition switched off the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.
3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency).  
Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

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We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.



# After-sales Service

## Technical Bulletin

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### BREAKERLESS TRANSISTORIZED IGNITION SYSTEM

22

#### Warranty note

VDT-I-227/103 En  
3.1979

Hybrid construction trigger boxes  
0 227 100 100 for ignition distributor  
with Hall generator (TCI-h)  
0 227 100 102 for ignition distributor  
with induction-type  
pulse generator (TCI-i)

Apart from the well-known TCI trigger boxes 0 227 100 0.., trigger boxes of hybrid construction have been fitted as standard since 9.78 (Fig. 1).

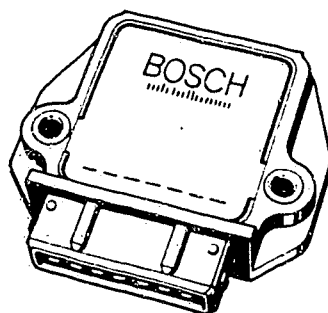


Fig. 1

#### Warranty procedure

If the complaints are justified, all these hybrid trigger boxes are to be sent, along with completed warranty documents, to your authorized representative for forwarding to the following address:

ROBERT BOSCH GMBH  
KH/LAV - Auspackraum

zur Weiterleitung an K1/VAK 21

D-7000 Stuttgart 30

This instruction remains valid until further notice.

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# After-sales Service

## Technical Bulletin

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NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En

1.1983

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Coil ignition	SZ (CI)	-----	Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I* (TCI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
	TSZ-H	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized ignition	TZ-I* (TI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in Hybrid technique)	TZ-H* (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)



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Opel



Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Breakerless semiconductor ignition with or without knock control	EZ EZ-K	- K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributorless ignition with or without knock control	VZ VZ-K	- K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

\*Note: The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).



# After-sales Service

## Motor Vehicle Service Information

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INCORRECT DISPLAY OF ROTATIONAL SPEED AND  
DWELL ANGLE ONLY WITH TRIGGER BOXES  
0 227 100 ... (TCI-i, TCI-h) WITH CURRENT  
LIMITATION

VDT-I-Gen. 030 En  
6.80  
Supersedes Ed. 3.80

For additional information see VDT-I-Gen. 032 En

### 1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00}	Rotational-speed	KTE 001.00
001.01}	display O.K. with these	001.02
001.02	testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild- ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan-Datsun	(Hitachi ignition system)
Fiat	(Delco ignition system)	Peugeot	(Bosch ignition system)
Ford	(Delco ignition system)	VW	(Bosch/Fairchild ignition system)
General- Motors	(HEI-ignition system)	Bosch transistorized ignition system for retrofitting 0 227 100 920	

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## 2. Test instructions

### 2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min<sup>-1</sup> to 1200 min<sup>-1</sup>).

It is, however, possible to attain correct rot.-speed measurements as follows:

Connect a ballast resistor of 0.9 or 1.0 Ohm (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

### Suggestion for user manufacture

Required parts:

- 1 ballast resistor 0.9 Ohm
- or
- 1 ballast resistor 1.0 Ohm
- 2 blade receptacles e.g.
- approx. 0.2 m cable, 1.5 mm<sup>2</sup> e.g.
- 2 insulated clips

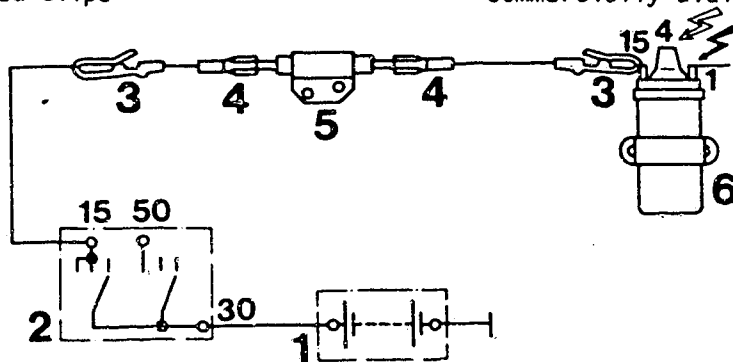
Part No. 0 227 900 002

Part No. 0 227 900 101

Part No. 1 901 355 881

Part No. 6 210 150 150

Commercially available



1 = Battery

2 = Ignition switch

3 = Clips

4 = Blade receptacle

5 = Ballast resistor

6 = Ignition coil

⚡ approx. 400 V

⚡ approx. 25 kV

### 2.2 Dwell angle

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

### 2.3 Ignition point

Is displayed correctly. Connect tester as per operating instructions.



# After-sales Service

## Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party

### MOTORTESTER CONVERSION

Incorrect display of rotational speed,  
dwell angle and ignition point  
only with trigger boxes  
0 227 100 ... (TCI-i, TCI-h) with current  
limitation

VDT-I-Gen. 032 En  
6.80

For additional information see VDT-I-Gen. 030 of 6.80

Re.: Motortester EFAW 268  
268 S 10  
269  
214 B  
AE 2000

#### 1. General

Please make sure that the above-mentioned motortesters in your workshop and at your customers (e.g. motor vehicle workshops, oil companies, gas stations, vocational schools etc.) are converted. The conversion is subject to payment and is carried out by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with fitting of switch).

#### 2. Why motortester conversion?

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle as well as to incorrect triggering of the meter when testing the ignition system. There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing light is triggered by the signal path dwell angle - meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

#### 3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing light is triggered by the clamp-on induction pickup and the pulse shaper stage.

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#### 4. Test instructions

##### 4.1 Standard ignition systems

Switch position: "standard"

All other tester connections as per operating instructions.

##### 4.2 Ignition systems with current limitation

Switch position: "current limitation"

In order to trigger the timing light, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

~~The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.~~



# After-sales Service

## Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

TESTS ON ELECTRONIC IGNITION SYSTEMS  
(TCI, TZ)  
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En  
3.1981

The following tests are listed in older and current Tester operating instructions or in Trouble-shooting with the oscillograph.

- "Separate ignition coil test" (concerns EFAW 213, 214, 268, AE 2000).
- Calculating the "ignition voltage reserve" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- "Intensified insulation test" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7-Information K7-VJF 17/8012.

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